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PUBLICATION OF SCIENTIFIC ARTICLES

PUBLICATION in science is the most effective means by which research is encouraged, collaboration between scientific individuals and teams made possible, scientific problems discussed, hypotheses criticised and suggestions made, and scientific information and news disseminated. However, with the phenomenal increase in the applications of science to human welfare and the consequent patronage provided by the public to science, the problem of affording proper publication to scientific studies in relation to the space available in the various journals has become more and more important and difficult. The publication of a research paper is to a large extent based on the co-operation between the author and the editor of the journal in which it is to appear. In this connection, the very pertinent remarks made by Mr. L. J. F. Brimble, Joint Editor of *Nature*, during the course of an address entitled, "Science and the Press" delivered before the Royal Society of Edinburgh recently, deserve careful consideration.

Mr. Brimble draws particular attention to the tendency of authors to send half-baked papers for publication. As he says, it must inevitably be left to the learned societies, editorial committees or individual editors to decide what shall be published, but there is still a tendency these days among scientists to rush into print. More often now than ever before some scientists, having submitted a communication for publication, eventually ask to withdraw it or to be allowed to modify it because they have either discovered an error or have since learnt that some of the work has been done elsewhere. This tendency is also revealed in the appalling state of corrected proofs received from some authors—sometimes peppered with corrections and changes which are anyhow very expensive to make. Rushing into print is also inspired by the bugbear of priority. For example, the request by an author that his communication should be treated as urgent because he has learnt that similar work is being done (usually in the United States) is now treated like the

cry of "Wolf! Wolf!" It is happening far too often. How refreshing it is when one team of workers, having heard that another is working along the same lines, gets into touch with the second group and arranges a joint communication!

There is much complaint today concerning the amount of scientific literature which each scientist must read if he is to keep pace with his own subject. There are many reasons for this overwhelming spate, not the least of which is the over-enthusiasm of scientists themselves. Too many of them imagine that just because they have written a scientific paper it is worthy of publication. The result is that the whole field of our literature extends over a very wide range of scientific merit.

Much of the detail published in a research paper is of limited interest and value. Men of science might well consider publishing only the main points of their research and fling the rest for possible reference. It was the late Lord Rutherford who once said that when writing a letter to *Nature* if you cannot say all that is really necessary in 500 words or less, then something is wrong.

It may not be a bad idea, according to Brimble, if every communication submitted were returned without even being read, with a covering note asking: (1) Are you sure you have said what you want to say? (2) Have you said it in the minimum number of words? (3) Is it worth

saying at all? Too many scientists, especially the younger ones, seem to assume that the value of a scientific paper varies directly as its length. It might therefore be strongly urged that men of science thoroughly train themselves to keep their pens dry until they know the facts or are sure of what they wish to say.

There is no doubt about it that although scientific publications are a valuable contribution to the unity of knowledge, the very great output of records of research has placed scientific societies and journals in a difficult position. The years since the War have also seen the publication of many new learned journals. Some of these have certainly filled important gaps; but by and large one may not say that all this additional publication goes far in solving the problem.

The long rows of periodicals on our library shelves continue to grow; but still the papers come in and the rate of flow increases. This may be a healthy growth in that it reflects the developing activities of men of science, but some form of control seems desirable, for there are all sorts of practical difficulties involved, and the time might well come when it will be impossible to print all the papers, much less read those which are printed. Surely, therefore, we should make it our business to see that our scientifically acquired knowledge is rightly stated if it is to be rightly used.

INDO-PACIFIC FISHERIES COUNCIL

THE Fifth Meeting of the Indo-Pacific Fisheries Council was held in Bangkok, Thailand, from January 22 to February 5, 1954. The session was opened by Field-Marshal Phin Chunhawan, Minister of Agriculture, Thailand. The Council was attended by thirteen out of sixteen member-nations. Various matters relating to fisheries development of the countries of South-East Asia were discussed during the session. The Indian Delegation to the Council was led by Dr. N. K. Panikkar, Chief of the Central Marine Fisheries Research Station at Mandapam.

A resolution urging the F.A.O. to establish training centres for master fishermen in the Indo-Pacific area which was moved by India was accepted by the Council. Collaborated projects for the study of the Indian mackerel, *Rastrelliger*, were recommended to those member-governments who have this valuable fishery. Emphasis was laid during the discussions on fish culture, prevention of water pollution by industrial development, and the need for adequate protection of fisheries during the

execution of river valley schemes. Along with the Council's session, a symposium was held on plankton which was jointly organized by the IPFC and the UNESCO, and in which distinguished experts including Prof. A. Thienemann (Germany) and Dr. Fish (U.S.A.), participated. Technical papers bearing on the various problems of fisheries of Asian countries were presented and the delegates took the opportunity to study at first-hand some aspects of the fisheries of Thailand especially the culture of *Tilapia* in the freshwaters of Thailand. The Council accepted the invitation of Japan to hold its next session in Tokyo in October 1955; and elected Nai Boon Indrambarya (Thailand) as Chairman, Mr. J. A. Tubb (U.K.) as Vice-Chairman, Dr. N. K. Panikkar (India) as Chairman of Technical Committee on Biology and Hydrology and Dd. Qureshi (Pakistan) as Chairman of Technical Committee on Technology. For the next session the subject chosen for symposium is: Prawn (shrimp) Fisheries including the biological, fishing and the technological aspects.

ON CERTAIN NEW ASPECTS OF THE THERMAL PATTERNS ASSOCIATED WITH NOR'WESTERS OVER NORTH-EAST INDIA AND EASTERN PAKISTAN

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IN two recent issues^{1,2} of this Journal, the present authors had pointed out that a large proportion of the thunderstorms (with or without surface squalls) in North-east India and Eastern Pakistan in the nor'wester season is associated with cold thermal troughs or cold pools in the middle and upper troposphere, the regions of development of the thunderstorms and their intensities depending upon the positions and intensities of the thermal systems. The authors had also been led to the conclusion from the available evidence that advection of colder air in association with these systems might be the final determining factor in the outbreak of these thunderstorms, especially of those associated with typical surface squalls (nor'westers). The authors would like to amplify in the following paragraphs their views about the nor'wester problem a little more in detail:

(a) Adequate supply of moist air in the lower troposphere is undoubtedly an important factor in the development of nor'westers; a cold trough or cold pool in the mid- and upper troposphere with dry tropical continental air in the lower troposphere cannot result even in an overhead thunderstorm, much less in the spectacular nor'wester which is often associated with fierce rainsqualls near the ground. To explain this point by one more example, upper level cold troughs and cold pools develop and move across North-west India and Western Pakistan, influencing the weather³ over these regions but the incursion of moist air in the lower troposphere in these areas is infrequent and inadequate with the result that the frequency of development of thundery weather is much less than the frequency of development of the cold thermal systems. In contrast to this, in West Bengal, Eastern Pakistan and the adjoining areas, adequate supply of moist air is available on most of the days in the nor'wester season on account of the location of these regions with respect to the Bay of Bengal. Consequently,

as pointed out by the authors in their previous papers, the problem of the weather analyst is to judge not whether there is enough moist air to produce the nor'wester but whether the thermal structure in the middle and upper troposphere is favourable or not for the release of the energy† from the moist air.

(b) The main role played by advection of colder air in the middle and upper troposphere seems to be to establish the steep lapse-rates required for the development of pronounced instability. An examination of a large number of cases of partial thickness patterns in relation to the actual winds has led us to the conclusion that this thermodynamic process of cold-advection is of great importance in the outbreak of nor'westers. Hence we had tentatively suggested that this cold advection might be the final determining factor in the development of the phenomenon. We would, however, point out that there are other processes at work in the middle and upper troposphere which would also contribute to the development of the nor'westers. For instance, one would expect convergence^{3,4} and upward motion in the eastern half of the trough and divergence and downward motion in the western half of the trough. Such upward and downward motions in the two halves of the trough would be consistent with the asymmetric distribution of the thunderstorms observed by us. As a matter of fact, we are inclined to the view that thermal vorticity in the middle and upper troposphere is a factor of importance in the development of the nor'wester and that the perturbations associated with this vorticity should increase or suppress the perturbations due to other causes such as orographic lifting, surface heating, etc. The evaluation of the "development term"⁵ in the expression for "relative divergence" between different isobaric levels should, in our opinion, give a more quantitative idea of the impulses associated with the thermal trough. This evaluation has been done by one of us for one or two nor'wester situations and the

*A more detailed discussion of this aspect will be found in a paper by one of the authors in which the monthly normal total and partial thickness patterns at 700 and 500 mb. levels and partial thickness patterns at the 300 mb. level over India and Pakistan are being discussed with reference to the normal distribution of thunderstorms and dust-storms.

† The mechanisms, available in the lower troposphere, no doubt contribute to the release of this energy but, as shown by the authors in their earlier papers, these mechanisms are less important than those in the middle and upper troposphere.

results have been encouraging. The details of these computations will be published elsewhere.

(c) The development of nor'westers will naturally be a maximum in the afternoon in the plains of West Bengal and Eastern Pakistan as, during this period, the upward impulses in the lower troposphere due to insolation, will be a maximum and in phase with the upward impulses associated with the thermal trough in the middle and upper troposphere. Likewise, in the valleys of Assam, the maximum of nor'wester activity should be in the night as low-level convergence in these valleys and the upward impulses resulting therefrom will be a maximum¹¹ during the night and will be in phase with the dynamical processes aloft.

(d) The mechanism suggested above does not in any way preclude the possibility of thunderstorms to the west of the thermal troughline, as advection of colder air may take place in this region also by the aid of the wind-shear and due to transport of isotherms. Normally, however, the flow patterns in the nor'wester season are not favourable for such cold advection and hence the thunderstorms tend to be concentrated in the eastern half of the thermal trough.

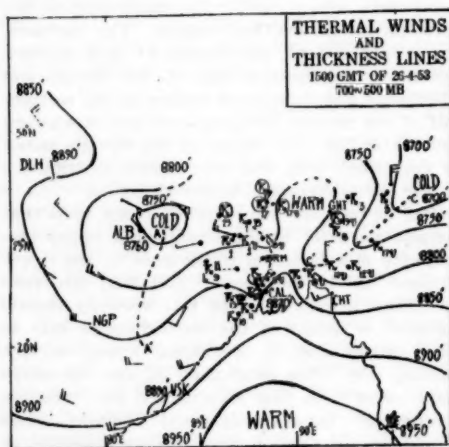


FIG. 1

With a view to illustrate qualitatively the points brought out in the above paragraphs, the 500 and 300 mb. partial thickness patterns on the evening of the 26th April 1953, are reproduced in Figs. 1 and 2. The thermal patterns for this day have not been discussed by us in our earlier papers and, as such, are of additional interest. The wind arrows in Fig. 1

denote thermal winds between 10,000 and 20,000'. Winds at 18,000' were used when 20,000' winds were not available. The wind arrows shown in Fig. 2 denote the thermal winds between 20,000 and 30,000'. The thunderstorms which developed between the 03 G.M.T. of 27th and 03 G.M.T. of 28th have been superposed on the 500 mb.

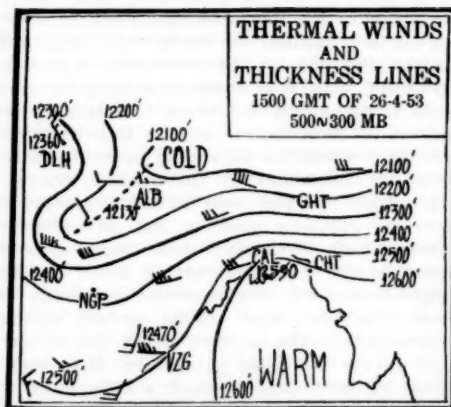


FIG. 2

partial thickness pattern according to the practice followed in our earlier papers. It will be seen that most of the thunderstorms occurred in the afternoon and evening of 27th. However, as some thunderstorms, e.g., along the foot of the Himalayas, developed before 03 G.M.T. of 27th but later than the mean hour of the thickness pattern, they have also been plotted on the chart. The times of commencement of the thunderstorm have been given in G.M.T. In the case of a few thunderstorms, the G.M.T. timings happen to fall on the 26th, e.g., in the case of Gauhati. Such thunderstorms have been shown enclosed in circles to avoid confusion of dates. The stations which experienced squalls have been shown by the symbol "q" at the bottom of the thunderstorm symbol. The positions of the stations have been shown by black dots.

The nor'wester which swept over the City of Calcutta and its neighbourhood on the afternoon of 27th was of unusual severity. The Calcutta Airport recorded a squall of 82 m.p.h. but the Barrackpore Aerodrome which is about 11 miles to the north-north-west of the Calcutta Airport (as the crow flies) apparently experienced a much heavier squall.

The chief points of interest in the 500 and 300 mb. partial thickness patterns shown in Figs. 1 and 2 are:

(a) In the 500 mb. pattern (Fig. 1), there is an extensive and well-marked cold thermal system between Long. 80° E. and 88° E. advecting cold air to the east. The trough line of this system has been shown by dotted line marked AA'. Superposed on this general system are:

(i) A weak thermal ridge over most of Chotanagpur and the contiguous Districts of Bankura and Birbhum in Gangetic West Bengal; (ii) a thermal trough over West Bengal and East Pakistan between 87° E. and 89° E. with trough line marked BB'. Note the W/WNW thermal winds over Asansol and Jamshedpur and southerly thermal wind over Calcutta. The latter, although weak, continued to be southerly even six hours later as seen from the radar winds and as such it is a significant wind; (iii) a pronounced warm thermal ridge over the position of North-East India and Eastern Pakistan, north of 23° N. between 89° E. and 92° E.; and (iv) a cold thermal trough over Assam with its trough line marked CC'.

(b) In the 300 mb. pattern, there is a deep cold thermal trough advecting colder air to the east. The trough line† has been shown by a dotted line in the diagram. There is also a pronounced confluent thermal jet‡ in the neighbourhood of Calcutta.

An examination of the sea-level and the upper-wind charts for the morning of 27th April shows that the boundary between the dry tropical continental air and the moist air from the Bay of Bengal ran roughly through Cuttack, Midnapore, Boga, Bhagalpur and Motihari below 5,000' above sea-level.

It is interesting to observe that:

(a) East Uttar Pradesh, East Madhya Pradesh and inland Orissa did not experience any thunderstorms although there was a cold thermal trough at the 500 and 300 mb. levels. The reason for this is that dry tropical Continental air was pervading the lower troposphere over that region.

(b) Practically, the whole of Chotanagpur experienced fair weather mainly because of the very poor supply of moist air into that region and partly because of the inhibiting effect of the feeble warm thermal ridge over that region at the 500 mb. level. It is significant that Asansol which is practically over the Chotanagpur Plateau and from which weather usually travels to Calcutta did not experience a thunderstorm on this day. The absence of thunderstorms in

the Berhampur-Naya Dumka region which was pervaded by dry continental air is specially interesting as it also shows that the thunderstorms in Gangetic West Bengal were not caused by 'chain-reaction' from the thunderstorms in Bihar.

(c) The portions of West Bengal, Assam and East Pakistan between 89° E. and 92° E. did not experience any thunderstorms in spite of the abundant supply of moist air in these regions. The authors would attribute this to the pronounced warm thermal ridge over those areas between the 700 and 500 mb. levels (the ridge is also seen between 500 and 300 mb. levels but the evidence is incomplete).

(d) The nor'wester which ravaged the Barrackpore Aerodrome and severely hit the Dum Dum Airport had its origin in the flat plains of Bengal not more than 60 miles to the north of Barrackpore to the east of the thermal trough line BB' at the 500 mb. level in which region there was not only abundance of moist air supply but there was also pronounced cold advection between the 700 and 300 mb. levels in association with the extensive thermal system mentioned above, besides a very well marked confluent thermal jet between the 500 and 300 mb. levels.

The above paragraphs set out broadly the authors' ideas about the mechanism of the nor'wester. To summarise these ideas in more graphical language, if the nor'wester can be compared to an explosion, the gunpowder required for the explosion is the energy-producing moist air from the Bay of Bengal. This gunpowder may be 'warmed up'—sometimes very well indeed—by the lower tropospheric agencies such as, insolation, orographic lifting and lower level convergence but the powder does not explode. The agency which ignites the powder intrudes into the scene much higher aloft—in the middle and upper troposphere—in the form of cold air advection and vertical movements of air associated with thermal patterns. The result is the spectacle of the nor'wester with its devastating consequences.

1. Ramaswamy, C. and Bose, B. L., *Curr. Sci.*, 1953, **22**, 103.
2. —, *Ibid.*, 1953, **22**, 291.
3. Sverre Pettersson, *Quart. Journ. Roy. Met. Soc.*, 1945, **71**, 56.
4. London Met. Office Discussion on cold pools, *London Met. Magazine*, 1953, **82**, No. 969, 81.
5. Eady, E. T. and Sawyer, J. S., *Quart. Journ. Roy. Met. Soc.*, 1951, **77**, No. 834, 531.
6. Bleeker, W. and Andre, M. J., *Ibid.*, 1951, **77**, No. 332, 260.
7. Sutcliffe, R. C., Forsdyke, A. G., *Ibid.*, 1950, **76**, No. 325, 189.

† This trough line runs to the west of the trough line marked AA' in Fig. 1. The authors have already pointed out in their earlier paper that the 300 mb. trough line runs to the west of the 500 mb. trough line, on the days of severe nor'westers.

CALCIUM OXALATE CRYSTALS AS AN INDICATOR OF NUTRIENT BALANCE IN THE TEA PLANT (*CAMELLIA SINENSIS*)

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IN course of investigations at this station it has been observed that the number of calcium oxalate crystals in the phloem parenchyma of the tea leaf petiole is notably constant for a particular phenotype or clone, and is not appreciably influenced by minor variations of cultural conditions. For the purpose of observation, expanded leaves of comparable age are collected and a transverse section of 20 μ thickness is cut from each petiole. A count of all the visible crystals of calcium oxalate in the whole of the phloem parenchyma of the section is made with a low power objective. This number has been called the 'phloem index'.

The phloem indices of three clones, cultivated under full sun in two localities, where soil conditions are slightly different, are given in Table I.

TABLE I

Phloem index for plants growing in full sun in localities approximately one mile apart

Clone	Locality A	Locality B
19/29/13	134.1 \pm 6.60	135.2 \pm 7.36
20/23/1	35.5 \pm 5.05	26.0 \pm 2.12
1/7/1	77.3 \pm 5.74	78.6 \pm 5.25

For statistical purposes the records pertaining to individual tea plants within an experimental block, have been grouped on the basis of phenotypes roughly similar in respect of

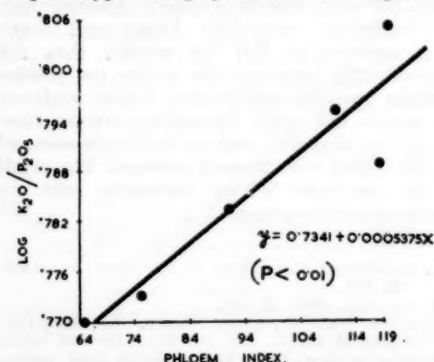


FIG. 1

foliar characters. By assembling separate records of potash and phosphate analyses of leaves removed from these plants in the past, it is possible to construct Table II which sug-

gests that the nature of the relation between the phloem index and the potash to phosphate ratio of a phenotype will prove to be that illustrated in Fig. 1.

TABLE II

Mean values for groups of roughly similar phenotypes arranged in a cline of gradations from the Assam type (1) to the China type (6)

Groups of phenotypes	K ₂ O/P ₂ O ₅	Phloem Index (P _i)
1	5.882	64.8
2	5.935	75.1
3	6.242	110.2
4	6.378	119.7
5	6.150	118.2
6	6.075	91.5

When an adequate number of petiole sections is examined from different commercial populations (jats or provenances) which are commonly planted in the plains of Assam, then it is observed that the mean phloem index of a population bears a direct correlation to the total number of shoots which are removed in one year by plucking. This is illustrated in Fig. 2 in which each point is derived from one

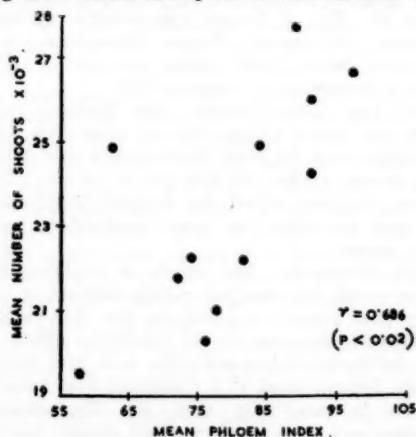


FIG. 2

provenance or population raised from a distinct seed source. The phloem indices were determined in 1951 and the meristic growth in 1952. It is our experience that the between provenance differences in respect of either fac-

tor remain constant in direction. We therefore conclude that a difference in the number of oxalate crystals is associated with a difference in the meristic growth when the magnitude of both these variates is genetically conditioned.

These observations suggest that the phloem index may be of considerable metabolic significance. It appears that the production of oxalic acid increases with the increase in meristic growth and to maintain the acid-base equilibrium in the tissue, proportional uptake of calcium takes place.⁴ In view of the well-known antagonism between Ca and K ions,³ uptake of potassium is likely to diminish as the result of increased uptake of calcium. Some evidence for this is given in Fig. 3 where the ash con-

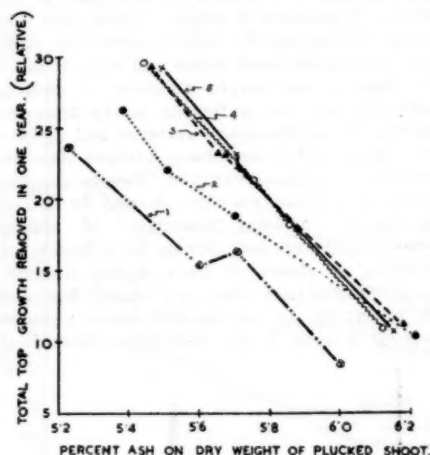


FIG. 3

tent of the plucked shoots, which is composed of about 40 per cent. of K_2O , is shown to be inversely related to the green weight of top growth which is removed from a tea bush in one year as prunings and plucked leaf. The numerals 1 to 5 indicate data for five separate provenances.

However, for the relation in Fig. 1 to hold good, any diminution in the potash content of the leaf must be followed by a much larger fall in the leaf phosphate. This could be possible either by a reduced uptake of phosphate or by dilution of the available phosphate in a larger mass of growth.

Whatever may be the cause, the phloem index which is associated with an increased meristic growth, appears to indicate the potash-phosphate balance.

Earlier work at this station¹ showed the potash-phosphate ratio to be associated with

susceptibility of the tea plant to attack by *Hemiteles*. Chapman and Gray² found the potash-phosphate ratio to be of importance in determining the response of the oil palm to potash or phosphate manuring.

The mean phloem index of twelve populations of tea plants each raised from a different commercial source of seed (provenance or *jat*) has been determined. The populations have been grown in full sunlight and also under a shade canopy of *Albizia stipulata*; and under either illumination intensity have received the two treatments of no nitrogen and 100 lb. of nitrogen as sulphate of ammonia. The design of the experiment is due to F. Yates of Rothamsted and takes the form of partially confounded split plots. The analysis of variance of the phloem index is given in Table III.

TABLE III
Analysis of variance of phloem index (P_i)

Source of variance	D.F.	Mean square	F
Replicate (between block pairs)	2	568.308	..
N x <i>jat</i>	3	..	..
Shade (within block pairs)	1	21.390	..
N x <i>jat</i> x Shade	3	2492.099	..
Error	2	..	..
Blocks	11	1302.129	..
Nitrogen (within blocks)	1	457.603	5.783*
<i>Jats</i> (Provenances)	11	2230.661	28.268†
N x Shade	1	123.396	..
<i>jat</i> x Shade	11	119.184	..
N x <i>jat</i>	11	77.613	..
N x <i>jat</i> x Shade	11	159.919	2.021*
Error	86	79.124	..
Total	143	..	..

* Significant at 5% level; † Significant at 1% level.

This analysis enables us to conclude that a population of tea plants (provenance) is characterised by a specific phloem index. Light intensity and sulphate of ammonia together but not separately interact with provenance to cause an alteration of the phloem index. In respect of phloem index, the conjoint factors of shade and nitrogen have a differential effect on various kinds of tea population.

The authors wish to thank the Director of the Tocklai Experimental Station and the Indian Tea Association for permission to publish these results.

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TYPES OF FLOWERING BEHAVIOUR IN RICE '*ORYZA SATIVA* LINN.' AND THE DISTINCTIVENESS OF THE AMAN TYPE

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DATE OF EAR EMERGENCE, also called 'Flowering time', has been studied from the physiological as well as the genetic point of view in Japan, U.S.A., India and other countries. It was shown by a number of Japanese workers^{1,2} that flowering in rice is hastened by short photoperiods. Some varieties were shown to be definite short-day plants and others to be "less sensitive" in the U.S.A.³ In India, different types of rice are grown in different seasons. There are autumn-winter (*Aman*), spring (*Boro*) and summer (*Aus*) varieties. It is generally known that *Aman* varieties tend to flower about certain fixed dates in autumn or winter irrespective of the date of sowing while *Aus* varieties tend to flower after a fixed number of days following any date of sowing. Late sown *Aman* varieties flower in spring. It has been suggested that *Aman* varieties require a fixed daylength for flowering which occurs naturally both in autumn and spring.⁴ *Aus* varieties are generally considered to be indifferent and *Aman* varieties to be sensitive to photoperiods. Experiments conducted with *Aman* varieties have shown them to be short-day plants.⁵ A few *Aus* varieties examined showed that they were not short-day plants but

were possibly long-day ones.⁶ Genetic investigations have shown the presence of a number of genes (symbolised as F_1 , F_2 , ..., etc.⁷) including an inhibitory gene (Ifl) causing monofactorial to multifactorial inheritance of this character. The F_1 genes have also been found to be linked with other characters (height, etc.)^{8,9} in different chromosomes.

During 1951-53, the author grew 31 varieties of rice (10 *Aman*, 5 *Aus*, 2 *Boro*, 8 U.S.A., 5 Japanese, and 1 Javanese) in the open at the Calcutta Presidency College. There was one sowing of every variety every month. The dates of ear emergence were noted and Figs. 1 and 2 show some of the graphs obtained. A striking observation was the uniformity in the flowering behaviour of all the *Aman* varieties and its contrast with all other non-*Aman* (Indian *Aus* and *Boro* and all foreign) varieties. Twelve monthly sowings of 6 *Aman* varieties showed 54 flowerings during October-December, 18 during January-April and none during May-September. Flowering of *Aman* is fixed during autumn-winter. If that fails, there is a second flowering time in spring. In all the non-*Aman* varieties flowering is more or less distributed throughout

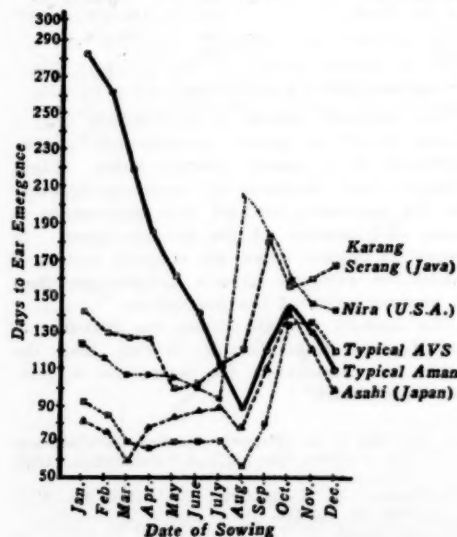


FIG. 1

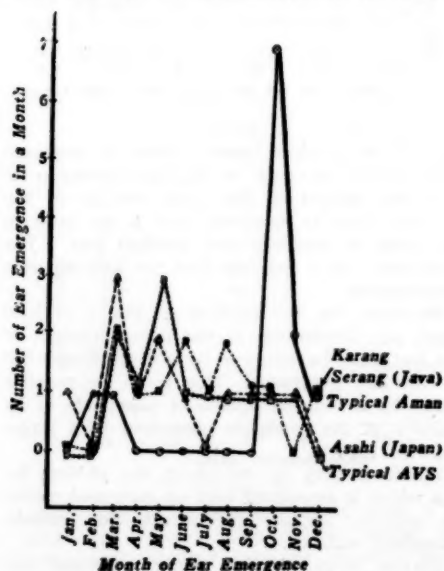


FIG. 2

the year excepting the cold winter months and a consequent increase of flowering in spring.

There is nothing peculiar in the behaviour of the *Aman*, *Aus* and *Boro* varieties which may perhaps be explained by the sensitiveness of the *Aman* to photoperiods and the indifference of the others. But, the same argument does not explain the *Aus*-like behaviour of all the foreign varieties which are known to include many sensitive ones.^{1,2,3} In a previous experiment, the author grew (1947 to 1949) six of the foreign varieties (4 U.S.A., 1 Japanese and 1 Javanese—all included in the later Indian experiment) in the U.S.A. in open rice fields during warm seasons and in temperature-controlled green houses during winter. The result is shown in Fig. 3 which shows that two were highly sensitive short-day varieties

(Asahi and Cody), three were slightly sensitive or indifferent (Zenith, Nira and Arkansas Fortuna) while the sixth (Karang Serang) seemed to be a long-day one.

The experiment conducted in India, thus, clearly brings out the distinctiveness of the *Aman* type as opposed to all other non-*Aman* varieties. The flowering behaviour of the non-*Aman* varieties, as shown in this experiment, does not show any distinction between short-day, indifferent and long-day varieties and between *indica* and *japonica* types that are included within this assemblage. Possibly, the interaction between daylength and other environmental factors controlling flowering time is different in the *Aman* and non-*Aman* groups.

Further investigation is likely to show that while the *Aman* varieties have a particular *Fl* gene, the non-*Aman* assemblage includes different short-day, indifferent and long-day genes which are differently affected by other environmental factors. Such work is being undertaken. Also, the distinctiveness of the *Aman*, which may be considered as a seasonal ecotype within the *indica* subspecies, may have some bearings on the evolutionary history of the rice species.

A detailed report of the above work will be published elsewhere.

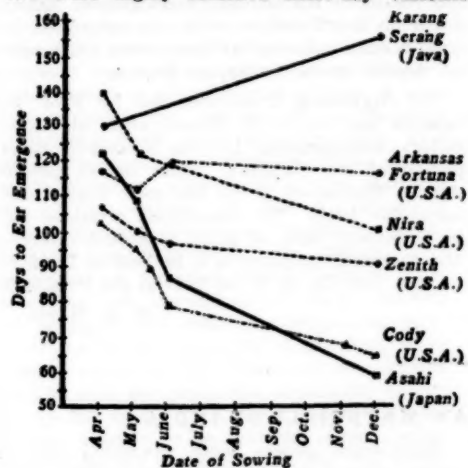


FIG. 3

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UNESCO SCIENTIFIC EXHIBITION IN INDIA

THE second of the mobile scientific exhibitions organised by UNESCO with the co-operation of scientists and manufacturers of scientific instruments is now in India at the invitation of the Indian National Commission for Co-operation with UNESCO. The first exhibition which travelled in the Latin American countries in 1949-50 was prepared on the twin theme of physics and astronomy. The present travelling exhibition which was on view this month at Calcutta is designated as 'Our Senses and the Knowledge of the World'. It consists of about 50 experiments which the public can

perform, and these are divided into five sections, namely, touch, hearing, smell, taste and sight. Twenty illustrated panels explain to the visitor the main points that he should know about each sense.

The Exhibition is in charge of Mr. P. C. Bandyopadhyay who was formerly Assistant Scientific Officer of UNESCO South Asia Science Co-operation Office at New Delhi. The local arrangements are being made by the State Governments, which have invited the Exhibition to various centres.

THE XIV INTERNATIONAL CONGRESS OF ZOOLOGY, 1953

THE Fourteenth International Zoological Congress was held in Copenhagen, Denmark, during August 5-12, 1953. It was attended by delegates from 48 countries; India was represented by the single delegate from the University of Travancore. His Majesty Frederick IX, King of Denmark, was the Patron and the University of Copenhagen was the host institution.

There were 16 sections, at which nearly 260 communications were discussed, and there were general meetings where about 15 papers were presented. Forming an important event in the Conference was the colloquium on the problems of zoological nomenclature, convened by the International Committee, to discuss a vast number of topics, and in the final session of the Congress, the report and recommendations were adopted. Recently the amendments adopted have been published by Dr. Hemming (see *Nature*, 172, 830, 1953).

With a welcome address from Dr. Th. Kristensen, the Danish Minister, the Conference began. Prof. J. Z. Young, the year's President of the Congress, then delivered his address on "Some Thoughts on Zoological Communication".

Many of the papers read at the various sessions were of a high order, and the discussions which followed were instructive and

stimulating. A large number of communications dealt with the results of experimental work. Of especial interest, particularly in the physiology section, were the papers on the giant mitochondria (Dr. C. M. Williams); the neurosecretory cells, their cytology and probable function (in the wake of the First International Conference on Neurosecretion held in Naples in May 1953), and endocrinology of arthropods (Drs. L. Arvy, B. Possompes, M. Dupont-Raabe and others); and polarised light and arthropod vision (Dr. T. H. Waterman). An immense variety of papers was presented, in marine biology, ecology and embryology.

Of great interest was the colour film and the lecture by Dr. A. Fr. Bruun, on the methods and results of the Danish Oceanographic Expedition on the *Galathea*, with the exhibition of some rarities collected by them from the greatest depths at the Philippine Trench.

The Organising Committee led by Prof. R. Spaarck and Dr. A. Fr. Bruun made all satisfactory arrangements for the successful completion of the Congress. The Danish people showed themselves to be the most kindly and hospitable hosts. The excursions arranged for the members were of great biological interest. The Fifteenth Congress is to be held in London, in 1958, with Dr. G. R. De Beer as the President.

K. K. NAYAR.

SYMPOSIUM ON CERAMIC RAW MATERIALS OF INDIA

A SYMPOSIUM on the ceramic raw materials of India was organised under the joint auspices of the Central Glass and Ceramic Research Institute and the Indian Ceramic Society on the occasion of the latter's Silver Jubilee celebrations at Banarás during February 1954.

The symposium was attended by about 300 people and a special feature was the active interest taken by several of the leading industrialists and technical personnel from the works. Professor W. E. S. Turner of the Department of Glass Technology, University of Sheffield, also attended the symposium.

Forty-eight papers were presented out of which sixteen were read and discussed. The papers related to: occurrence including geology of the deposits; methods of studying raw materials; and methods of beneficiation.

Judging by the number of papers presented and the keen interest of the participants, it can be said that a feeling has been aroused to the need of a proper understanding and utilization of the raw materials in this field.

The symposium was held under the Presidentship of Dr. C. Atma Ram, Director, Central Glass and Ceramic Research Institute.

GEOLOGY OF INDIA*

DR. D. N. WADIA's *Geology of India* has been a standard work since its publication in 1919, for geology students and others interested in the subject. In the third edition there is a considerable revision of the subject-matter, and incorporation of recent work by officers of the G.S.I. and others. The special feature of the present edition is the inclusion of the geology and mineral resources of Kashmir in the body of the book in the place of a special appendix on the "Geology of Kashmir" in the earlier editions. In this process, there have necessarily been, in the words of the author, "a few repetitions and overlaps".

In the chapter on physiography, the more important additions are about the coasts of Malabar, Mekran and Coromandel; about the gravity measurements reviewing the important work of P. Evans and W. Crompton, and some additional information regarding earthquakes. In the second chapter, on stratigraphy, a welcome feature is the inclusion of the Standard Stratigraphic Scale, with its subdivisions. This enables the student to correlate Indian stratigraphic divisions with those of the standard scale. Fuller details of the Archæans of Mysore, Central Provinces, Southern Bihar, Gangpur and Mayurbhunj in Orissa, and Himalayas are recorded in this edition. On account of the divergence of views existing with regard to the relative stratigraphic position of the various members of the Peninsular Complex vis-a-vis the Dharwars, the author does not give any particular preference to one view or the other. The consensus of opinion, however, appears to be that the oldest recognisable rocks are the Dharwars, and the members of the Peninsular Complex are of a later date.

The chapters on Cuddapahs and Vindhya are for the most part kept intact, but reference is made to some recent work on the stratigraphic horizon of some of the members of the Purana group and to the reported occurrence of fossils and organic remains in the Vindhya, suggesting a possible basal Cambrian age to the topmost beds of the Vindhya. The author's remarks about the Vindhya and associated rocks of Rajputana are a welcome addition to the chapter. The chapters on Gondwana system have also been revised. Some additional information on the geotectonics of Gondwana

land, and the land bridge between the Gondwana land and the Angara land is given in this edition. A summary of the coalfields of India on page 187 is also new material added now.

In Chapter XV, the age of the Upper Cretaceous of Coromandel coast incorporating some work of Prof. L. Rama Rao and others is reviewed. Additional information on Lametas is also given. In the chapter on the Deccan Traps, the petrography and age of the Traps are brought up to date. In the Tertiary system, the new find of lignite in South Arcot District is mentioned. In the chapter on the Eocene system, the question of the age of the Saline Series is revived with reference to late Prof. Birbal Sahni's contribution in the context of Mr. Gee's views. On pages 332-33 of the same chapter, Eocene succession in Sulaiman range and reference to the find of oil in Potwar Plateau are given. It may be mentioned in passing that the later possibility was proved by the work of Dr. Wadia in the Himalayas. In the Oligocene and Lower Miocene systems, prominence is given to the recent work of Burma Oil Company geologists, thus bringing our information on the subject up to date. The inclusion of a note on the Siwalik fauna is of real value. In the chapter on Pleistocene system, recent work on glaciation in the Himalayas has been excellently summarised. Considerable material has been added to Chapter XXV on the physiography of India. In the last chapter, valuable information on the mineral resources and mineral statistics is given. A welcome addition, almost towards the close of the book, deals with the soil groups of India.

The new edition of Dr. Wadia's book has incorporated most of the recent advances in our knowledge of Indian geology and places in the hands of the students and the public a wealth of information, carefully sifted, properly arranged, and in a flowing style for which his book has always been famous. The get-up, the textual figures and geological sections and map are all that one can wish for. It will continue to have the wide popularity it has enjoyed since its first publication.

C. MAHADEVAN.

* *Geology of India*, by Dr. D. N. Wadia. Third Edition, 1953. (Macmillan & Co., Ltd.) Pp. xx + 531. Price 50 sh.

LETTERS TO THE EDITOR

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APPLICATION OF FERMI'S ATOMIC MASS FORMULA TO THE ESTIMATION OF ALPHA-DISINTEGRATION ENERGY IN THE RARE EARTH REGION

SEVERAL attempts have been made to set up a semi-empirical atomic mass-formula for the estimation of atomic mass $M(Z, A)$ of an element of mass number A and atomic number Z . The mass formulas developed by Bohr and Wheeler¹ and by Bethe-Weizsäcker² have been extremely useful in explaining and predicting many of the properties of the nuclei. But their inadequacy in their application to radioactive decay has been well established by many workers. The Fermi-Weizsäcker formula with Stern's correction term,⁴ though satisfactory in nuclides for $A \geq 212$ for alpha decay energy, has been shown to be inadequate in rare earth region.⁵ The systematics of alpha decay pro-

perties have been well defined by Perlman, Ghiorso and Seaborg⁶ and the properties of possible alpha-emitters have been predicted.

Recent mass measurements by Duckworth⁷ and their comparison with the estimated masses have helped to determine a correction-term which fits in well with the experimental results. The calculated masses have been compared with the observed ones in Table I below for $Z = 72, 60, 58, 56, 52$. From the study of variation of atomic mass with A and Z , the correction to the atomic mass has been estimated to be

$$\Delta m = 0.0185 - 2 [kA^{1.2} - k_1 Z^{1.5}] \text{ M.U.} \quad (1)$$

where $k = 0.0002$ and $k_1 = 0.00014$. The masses calculated using this correction-term are in better agreement with experimental results.

Let us consider an alpha-emitter of atomic mass $M(Z, A)$ and the daughter atom of mass $M(Z-2, A-4)$. The alpha disintegration energy is given by

TABLE I

Nuclides	Mass calculated	Mass observed	Mass calculated using correction term	Nuclides	Mass calculated	Mass observed	Mass calculated using correction term
$^{178}\text{Hf}^{178}$	178.0096	177.9936 ± 0.013	177.9942	$^{137}\text{Ba}^{137}$	136.9653	136.9502 ± 0.010	136.9503
$^{176}\text{Hf}^{176}$	176.0066	175.9923 ± 0.011	175.9945	$^{136}\text{Ba}^{136}$	135.9637	135.9488 ± 0.010	135.9507
$^{144}\text{Nd}^{144}$	143.9694	143.9560 ± 0.008	143.9591	$^{130}\text{Te}^{130}$	120.9626	129.9467 ± 0.039	129.9436
$^{142}\text{Ce}^{142}$	141.9692	141.9537 ± 0.009	141.9544	$^{128}\text{Te}^{128}$	127.9607	127.9471 ± 0.010	127.9450
$^{138}\text{Ba}^{138}$	137.9671	137.9498 ± 0.009	137.9502	$^{126}\text{Te}^{126}$	125.9573	125.9427 ± 0.010	125.9449

TABLE II

Nuclides	Observed $E_\alpha \times \frac{A}{A-4}$	E_α cal. from Fermi's formula	E_α cal. using correction-term	Nuclides	Observed $E_\alpha \times \frac{A}{A-4}$	E_α cal. from Fermi's formula	E_α cal. using correction-term
$^{145}\text{Pm}^{145}$	.. Mev.	-0.212 Mev.	1.638 Mev.	$^{130}\text{Gd}^{130}$	2.77 Mev.	0.975 Mev.	3.001 Mev.
$^{146}\text{Sm}^{146}$	..	-0.271	2.194	$^{149}\text{Tb}^{149}$	4.05	1.598	3.707
$^{147}\text{Sm}^{147}$	2.18	+0.077	1.988	$^{151}\text{Tb}^{151}$	3.53	1.250	3.290
$^{148}\text{Sm}^{148}$	..	-0.140	1.760	$^{150}\text{Dy}^{150}$	4.11	2.033	4.205
$^{152}\text{Sm}^{152}$	..	-0.751	1.090	$^{151}\text{Dy}^{151}$	3.69	1.863	4.023
$^{147}\text{Eu}^{147}$	2.87	+0.730	2.670	$^{151}\text{Ho}^{151}$	4.31	2.425	4.660
$^{148}\text{Eu}^{148}$	..	+0.717	2.637				
$^{147}\text{Gd}^{147}$	3.18	1.043	3.101				
$^{149}\text{Gd}^{149}$	3.08	0.997	3.034				

$E_\alpha = M(Z, A) - M(Z-2, A-4) - M(2, 4)$ (2)
Substituting Fermi's atomic mass formula³
 E_α in Mev. is given by

$$E_\alpha = -27.90728 + 13.03610 \left\{ \frac{A^{2/3}}{A-4} - \frac{(A-4)^{2/3}}{A} \right\} + 0.58383 \times \left\{ \frac{Z^2}{A^{1/2}} - \frac{(Z-2)^2}{(A-4)^{1/2}} \right\} + 931.15 \{ \delta(A, Z) - \delta(A-4, Z-2) \} \quad (3)$$

The last term in (2) is zero for A odd, Z (even, odd) and is

$= \pm 33.52140 \{ (A-4)^{-3/4} - A^{-3/4} \}$
for A even, Z (even, odd). And the correction to E_α is

$$\Delta E_\alpha = k_2 [Z^{1/2} - (Z-2)^{1/2}] - k_1 \times [A^{1/2} - (A-4)^{1/2}] \text{ Mev.} \quad (4)$$

where $k_2 = -2.6072$ and $k_1 = 0.37246$

The calculated alpha-decay energy with and without correction-term has been shown below in Table II along with the observed data wherever available.

It is seen that for Sm^{146} the calculated value is 1.998 Mev. while the observed one is 2.18 Mev. For other isotopes of samarium such as Sm^{148} and Sm^{152} the estimated values are 1.76 and 1.09 Mev. respectively and thus they will have half lives of the order of 10^{14} to 10^{15} years and hence will behave as stable nuclei. Thus the inevitable conclusion is that the natural alpha-activity of samarium should be definitely assigned to Sm^{147} as has been shown experimentally by Weaver and others.⁹ The estimated

value for Sm^{146} is 2.19 Mev., and therefore a part of the natural alpha-activity of samarium may as well be assigned to Sm^{146} . The prevailing notion that it does not exist in nature may be due to the fact that its relative abundance is such as to escape detection so far by experiments. The results calculated using the correction-term in case of Dy-isotopes also are in close numerical agreement.

University Dept. of Physics, G. P. DUBE.
Patna University, L. S. SINGH.
Patna, January 16, 1953.

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MENTAL ESTIMATION OF TIME

THERE have been several studies¹ both in U.K. and U.S.A. about the accuracy of visual estimation of distance, but no study about the mental estimation of time (unaided by watch or counting), appears to have been made. This note presents a study of mental estimation of time by 15 members of staff of the Defence Science Laboratory, New Delhi.

The subjects were requested to mark five periods of 30, 60, 90 and 120 seconds by giving a signal (starting with a given signal). The true periods correct to the nearest second corresponding to their estimations were recorded by means of a stopwatch and were not known to the subjects. The estimations were made in a quiet air-conditioned room in absence of any clock or watch.

TABLE I

Regression of estimated time on true time for individual subjects

S. No.	r	a	b
1	0.989	12.7	0.700
2	0.978	2.8	1.084
3	0.907	-13.9	0.868
4	0.952	-18.0	1.090
5	0.974	-30.7	1.182
6	0.992	-1.1	0.840
7	0.998	-102.3	4.310
8	0.982	19.6	0.806
9	0.957	2.0	2.089
10	0.971	6.2	0.769
11	0.972	7.3	0.792
12	0.964	-39.0	1.433
13	0.999	-1.1	1.441
14	0.991	12.7	0.663
15	0.982	2.0	0.692

The correlation between estimated time E and true time T was uniformly high, above 2 per

the following relationship between the estimated time E and true time T.

$$E = a + bT,$$

where E and T are expressed in seconds. It is obvious that for perfect estimation $a = 0$ and $b = 1$.

A noteworthy feature of the data, presented in Table I, is that large departures of a from zero are not accompanied by low values of r , e.g., when $a = -102.3$, $r = 0.998$. This fact indicates that although estimates by a particular individual may be far from truth, the individual is fairly consistent in his errors for a number of estimates. Thus subject No. 7 has a large negative bias (a) and a slope of 4.31, indicating that the typically overestimated time by a factor of 4.31, less a constant bias of 102.3 seconds.

Table II presents the mean and standard deviation of true periods for the five estimations. These data give the following regression equations:

$$\begin{aligned}\bar{T} &= 0.968 E + 6.8 \\ \sigma_T &= 0.316 E + 0.6\end{aligned}$$

The quantities within brackets in this table are the values of \bar{T} and σ_T as calculated from the regression equations which fit excellently with the data.

The authors are extremely grateful to Dr. D. S. Kothari, Dr. R. S. Varma, Dr. A. Seetharamiah and Dr. P. V. K. Iyer for their kind interest in the investigation.

Defence Science Lab., MAHENDRA SINGH SODHA.
New Delhi, A. K. MEHTA.
December 7, 1953.

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TABLE II

Mean and standard deviation of true periods

E in seconds	..	30	60	90	120	180
\bar{T} in seconds	..	32.9 (35.8)	66.3 (64.9)	94.8 (93.9)	126.3 (123.0)	178.6 (181.0)
σ_T in seconds	..	10.5 (10.1)	21.0 (19.6)	26.3 (29.0)	39.7 (38.5)	56.8 (57.5)

cent. level of significance for all subjects except No. 3, in whose case also it was above 5 per cent. level of significance.

The slope of the regression line of the estimated time on the true time, however, varied considerably—as also did the individual bias in the estimations. These variable features of individual performance are summarised in Table I. In this table r refers to the coefficient of correlation and a and b are the constants in

ADSORPTION OF HYDROGEN AND CARBON MONOXIDE ON A COBALT CATALYST-PRESORPTION EXPERIMENTS*

IN the Fischer-Tropsch synthesis, interaction between chemisorbed carbon monoxide and hydrogen on the catalyst is considered to be an essential step towards reaction.¹ A study of such interaction may indicate the nature of the

substrate intermediates and afford an insight into the basic mechanism of the reaction. We have accordingly investigated the adsorption of hydrogen on a Fischer-Tropsch catalyst partly covered with carbon monoxide and *vice versa*.

The adsorption of hydrogen was determined on 3.73 g. of a reduced Cobalt-Thoria-Kieselguhr catalyst (100 Co : 18 ThO₂ : 200 Kg.) on which measured amounts of carbon monoxide were initially adsorbed ('presorbed') at the respective isothermal temperatures following the procedure outlined by Griffin.² In all cases the carbon monoxide so admitted was taken up completely and retained by the catalyst as manifested by the absence of any trace of it in the gas phase during the subsequent hydrogen adsorption. The amounts of carbon monoxide presorbed ranged from 0.04 ml. to 2.0 ml. The adsorption measurements on the bare and presorbed surfaces were carried out at 53°, 76° and 97°C. No traces of carbon dioxide, water vapour or hydrocarbons could be detected in the gas phase when the catalyst was treated with a carbon monoxide-hydrogen mixture at 97°C., indicating the absence of reaction. The adsorption measurements on the cleared catalyst were frequently repeated in between presorption runs. The concordance of the values for hydrogen adsorption so obtained checked the constancy of the surface characteristics of the catalyst.

Table I gives the values of ΔV_1 , i.e., volume of hydrogen adsorbed on the presorbed surface minus the volume of hydrogen adsorbed on the cleared surface under the same conditions.

TABLE I

Effect of presorbed carbon monoxide on the adsorption of hydrogen

Volume of CO presorbed ml. N.T.P.	ΔV_1 ml. N.T.P.					
	Pressure 30 cm.			Pressure 60 cm.		
	53°	76°	97°	53°	76°	97°
0.04	0.03	0.07	..	0.07	0.07	..
0.08	..	0.07	..	..	0.17	..
0.20	0.29	..	0.70	0.56	..	..
0.50	0.42	0.37	0.94	0.77	0.62	1.35
1.00	0.56	1.03	1.31	1.22	1.36	..
2.00	..	1.23	..	..	1.73	..

It is seen that the presorption of carbon monoxide enhances the adsorption of hydrogen under all conditions studied. ΔV_1 increases generally with the amount of carbon monoxide presorbed and with the temperature. These

results may be compared with those of Griffin on copper and nickel surfaces^{2,3} with the significant difference that the suppression effect observed by Griffin at higher pressures is absent in the present case.

The carbon monoxide initially admitted may be expected to be chemisorbed on the most active sites on the surface and cause the enhancement of hydrogen adsorption in two ways: (a) the activation of neighbouring centres of low activity, as envisaged by Griffin, and (b) complex formation between carbon monoxide and hydrogen involving valence forces. Both these factors may be simultaneously operative. Activation or complex formation may be expected to occur to a greater extent at higher temperatures, giving rise to larger enhancement of hydrogen adsorption at higher temperatures.

On the same sample of the above catalyst, the effect of presorbed hydrogen on the adsorption of carbon monoxide was studied at 53°, 76° and 97°C. The absence of displacement effects and the constancy of the surface characteristics of the catalyst during a series of adsorption experiments were verified as before.

Table II gives the values of ΔV_2 , i.e., the volume of carbon monoxide adsorbed on the surface with presorbed hydrogen minus the volume of carbon monoxide adsorbed on the bare surface under the same conditions. The amount of hydrogen admitted into the adsorption system did not exceed 1.5 ml. N.T.P. since larger volumes gave rise to measurable amounts of hydrogen in the gas phase during the subsequent determination of the carbon monoxide isotherm.

TABLE II

Effect of presorbed hydrogen on the adsorption of carbon monoxide

Volume of H ₂ presorbed ml. N.T.P.	ΔV_2 at pressure 20 cm.		
	53°	76°	97°
0.04	..	..	-0.30
0.20	-1.00	-0.25	-0.65
0.50	+0.35	-0.45	-0.85
1.00	+1.40	0	-1.00
1.50	..	0	-1.10

It is seen that at 53°, the first portions of hydrogen upto 0.20 ml. suppress the adsorption of carbon monoxide to a value below that obtained on the bare surface. Evidently this hydrogen is adsorbed on the most active sites to the exclusion of some carbon monoxide. The

next portions of hydrogen, however, cause an enhancement of carbon monoxide adsorption to a value higher than that obtained on the cleared catalyst surface. This difference in behaviour indicates that the latter amounts of hydrogen are adsorbed on sites dissimilar to those on which the first 0.20 ml. was adsorbed.

At 76°, the first portions of hydrogen upto 0.50 ml. cause a suppression of carbon monoxide adsorption and it is only when 1.0 or 1.50 ml. hydrogen is presorbed that the carbon monoxide adsorption comes up to the value obtained on the bare surface. At 97°, all doses of presorbed hydrogen upto 1.50 ml. cause a suppression of carbon monoxide adsorption. The first portions of hydrogen added have a relatively greater suppression effect than subsequent portions.

These results are strongly suggestive of being composed of two opposing effects occurring concurrently on different types of adsorptive sites on the surface. The presence of hydrogen on one causes a suppression of carbon monoxide adsorption; while carbon monoxide adsorption is enhanced with hydrogen present on the second type of sites. The relative extents to which hydrogen is adsorbed on the two types of sites at different temperatures, determine the overall effect on carbon monoxide adsorption.

The authors are thankful to Dr. Sir J. C. Ghosh for his keen interest in this investigation.

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Kharagpur, January 22, 1954.

* The experimental part of the work was carried out at the General Chemistry Section of the Indian Institute of Science, Bangalore, and formed part of the M.Sc. thesis of T. S. V., submitted to the Madras University in 1952.

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EXPONENTS OF THE ABSORPTION LAW FOR THE POLAR AND EQUATORIAL REGIONS

JOHNSON¹ suggested that the difference δ ($=\Delta n$) of the exponents of the absorption law $I = A/h^\delta$ for the polar and equatorial regions can be determined from an analysis, either of the latitude effect or of the east-west asymmetry. He also pointed out that a higher accuracy can be realised from the latter method. The change in exponent arises from the inclusion in high latitude measurements of low energy rays in

the range $\Delta r_e = 0.5 - 0.35 = 0.15$. The absorption of the asymmetric radiation can be determined from the variation of the asymmetry with the zenith angle. With an increase of zenith angle, the atmospheric path increases but there is also an increase in the energy range within which the asymmetric component lies. To correct for the latter effect, the asymmetry A is divided by the range Δr_e of the threshold energies for the two directions involved and multiplied by 0.15, a value selected as a standard range because it represents approximately the range within which the latitude sensitive radiation is included. In Table I are given the asymmetry and other data. The symbol $A' = 1 + 0.15 A/\Delta r_e$ and $h = 9.685 \sec \theta$.

TABLE I

Zenith angle θ	Asymmetry A	Δr_e	A'	h	$\log h$	$\log A'$
10°	0.038	0.044	1.128	9.833	0.993	-0.052
15°	0.059	0.066	1.134	10.02	1.001	-0.046
20°	0.073	0.089	1.123	10.30	1.013	-0.0503
25°	0.087	0.112	1.115	10.69	1.029	-0.0476
30°	0.091	0.136	1.100	11.19	1.049	-0.0414
35°	0.114	0.161	1.106	11.82	1.073	-0.0437
40°	0.122	0.187	1.098	12.64	1.102	-0.0407
45°	0.121	0.214	1.085	13.70	1.137	-0.0355
50°	0.114	0.241	1.071	15.07	1.178	-0.0298
55°	0.102	0.271	1.056	16.89	1.228	-0.0237
60°	0.086	0.301	1.043	19.36	1.287	-0.0182

The threshold energies at Hyderabad (geomagnetic latitude 7° 39') are calculated for the zenith angles concerned using the necessary formulae.² The minimum energy allowable at the vertical in India at the geomagnetic equator is 17.0 Bev. after corrections for tilt of the earth's magnetic field and eccentricity of the dipole are taken into account (Neher,³ Milli-

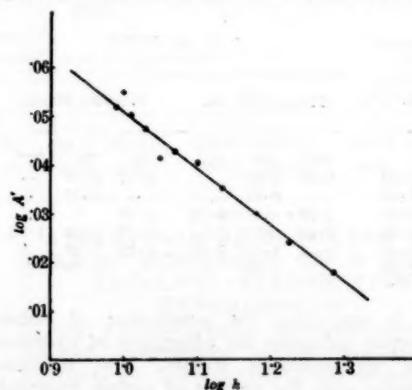


FIG. 1

kan⁴). The values of asymmetry corresponding to the zenith angles have been taken from the asymmetry curve already reported.⁵ A logarithmic plot of $A' = 1 + 0.15 A/\Delta r$, against the atmospheric path h (Fig. 1) shows that the points lie nearly on a straight line. The slope of this line gives a value of 0.12 ± 0.015 for δ which is in agreement with that reported by Francis and others¹ for $\lambda = 28^\circ 31'$ while the experiments of Johnson at Peru and Mexico gave a value of 0.16. The probable error is estimated from the scatter of the points in Fig. 1.

The author expresses his grateful thanks to Professor S. Bhagavantam for his valuable guidance.

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ISOBUTYL ALCOHOL-ACETIC ACID-WATER MIXTURE AS A SOLVENT FOR AMINO ACIDS

In the course of an investigation on amino acids using the circular paper chromatographic method, isobutyl alcohol-acetic acid-water mixture was tried as a solvent and found to be quite useful. The R_f values were reproducible to the second decimal place provided the distance of advance of the solvent front was kept constant.

The apparatus and general procedure adopted are based on the method described by Giri and Rao.¹ The amino acid solutions were prepared in concentrations of 0.1 per cent. in 80 per cent. alcohol. 2.5 μ l. of the amino acid solution were spotted at the centre of a Whatman No. 1 filter-paper. For irrigation of the filter-paper, a glass capillary tube of diameter 1.15 mm. and length 2 cm. was used in the place of the paper wick. The capillary tube is inserted in a small hole made at the centre of the paper and allowed to dangle into a petri-dish containing the solvent. Irrigation was continued until the solvent boundary had travelled a distance of 5 cm. from the centre and the time taken was about an hour. The paper was then removed, the solvent boundary marked in pencil, dried at room temperature and sprayed with 0.1 per cent. nin-

hydrin in acetone and dried at 55-60° C. for 30 minutes. The R_f values are the average of four determinations. Solvent: 40 c.c. of isobutyl alcohol, 10 c.c. of glacial acetic acid and 50 c.c. of water. This mixture was allowed to stand for sometime and the lower layer discarded.

TABLE I
 R_f values of amino acids

Amino-acid	Isobutyl alcohol-acetic acid-water	N-Butanol-acetic acid-water ²
Arginine	0.28	0.32
Lysine	0.32	0.28
Histidine	0.34	0.28
Asparagine	0.39	0.32
Cystine	0.40	0.20
Aspartic acid	0.44	0.37
Glycine	0.45	0.37
Serine	0.46	0.31
Glutamic acid	0.52	0.44
Threonine	0.53	0.40
Alanine	0.55	0.45
Proline	0.56	0.45
Tyrosine	0.70	0.57
Tryptophane	0.75	0.69
Methionine	0.78	0.75
Valine	0.79	0.72
Phenylalanine	0.80	0.75
Isoleucine	0.90	0.75
Leucine	0.91	0.78

It can be seen from Table I, that the R_f values of the amino acids as separated by isobutyl alcohol-acetic acid-water mixture are higher than those obtained with N-butanol-acetic acid-water mixture. It is further noted from Table I that arginine occupies the lowest position in the chromatogram. Lysine and histidine which are non-separable with butanol solvent, have distinct R_f values and are well separated. The R_f values show a gradual increase from 0.28 for arginine to 0.91 for leucine. Distinct and well-defined bands are obtained, and hence a useful separation of amino acids can be achieved. Although Consden *et al.*,³ reported secondary butyl alcohol as unsatisfactory solvent in that it moved amino acids too fast or unduly broadened the spots, it has been found that isobutyl alcohol-acetic acid-water mixture gave satisfactory results.

My sincerest thanks are due to Dr. S. C. Devadatta, and Dr. K. V. Giri, for their kind interest and continued encouragement.

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VITAMIN B₁₂ CONTENT OF THE RAT LIVERS IN ANEURIN AND RIBOFLAVIN DEFICIENCIES

A study of the vitamin B₁₂ content of the livers of different animals under normal conditions reveals a comparatively low amount of the vitamin in the livers of rats.¹ In this note is reported our work on the vitamin B₁₂ activity of livers of rats in aneurin and riboflavin deficiencies.

White albino rats (males) weighing about 50 g. were used as experimental animals. The experiment was performed in two batches of 48 rats each. Each batch of rats was divided into 4 groups—two for the control and experimental animals in aneurin deficiency and two for those in the riboflavin deficiency. The rats were separated in individual cages and were fed *ad lib* on the purified basal diet.² In addition, the aneurin group of rats received 10 per cent. autoclaved brewer's yeast and the riboflavin group of rats received an equal amount of alkali autoclaved brewer's yeast. Each rat of the control groups received aneurin, riboflavin calcium pantothenate and pyridoxine to the extent of 20, 45, 100 and 20 µg. respectively per day. The experimental animals in aneurin and riboflavin deficiencies received all these vitamins except aneurin and riboflavin respectively. Severe symptoms of aneurin deficiency were observed in about 4 weeks and those of riboflavin deficiency in about 8 weeks. The deficient and control animals were then sacrificed simultaneously. The livers were removed, weighed and analysed for vitamin B₁₂ activity by the microbiological method using *Leptobacillus leichmannii*.³⁻⁵ The results are given in Table I.

TABLE I
Mean vitamin B₁₂ content of control and deficient rats

Group	µg./g. liver	Batch
1 Aneurin		
(a) Control	55.45	I-(8)*
	53.76	II-(8)
(b) Deficient	24.20	I-(7)
	20.46	II-(6)
2 Riboflavin		
(a) Control	54.56	I-(10)
	52.60	II-(11)
(b) Deficient	32.79	I-(9)
	41.44	II-(7)

* The figures in the parenthesis refer to the number of animals used in the determination.

On applying the 't' test it is seen that the difference in the mean values of vitamin B₁₂ in the control and deficient animals is significant at 5 per cent. level of confidence. It appears that a deficiency either of aneurin or riboflavin leads to a deficiency of vitamin B₁₂ in the livers of rats. Several workers have reported such definite interrelationships between other members of the B group of vitamins.^{2,6,7} The above results suggest that vitamin B₁₂ is probably interrelated to aneurin and riboflavin. Work is in progress to study this aspect of the problem in detail. A detailed account of all the work will be published elsewhere.

We wish to express our thanks to the Trustees, Lady Tata Memorial Trust, Bombay, for the award of a research scholarship to one of us (R. V. B.) and to Shri M. S. Nadkarni for statistical analysis of the results.

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FEEDING WATER-MISCIBLE VITAMIN A TO DAIRY CATTLE

It has been reported by Sobel and co-workers^{1,2} that the oral administration of aqueous dispersion of vitamin A to lactating animals produces milk with higher vitamin A potency than those fed with oil-soluble vitamin A. Investigations at this Institute³ revealed that the water miscible form of vitamin A used for fortifying milk remained practically in the aqueous phase and if the milk was mechanically separated, most of the water miscible vitamin A could be recovered in the skim milk. It is not known whether the aqueous form of vitamin A fed to cattle will have any effect on the vitamin A content in the aqueous phase of the milk. Some work has been done in this direction and the results are presented here.

After a preliminary period of 1 week when the animals were maintained on ragi straw alone as roughage, 100,000 i.u. of water miscible vitamin A was fed daily to each animal as

a supplement for 4 days (period II). Later the dosage of vitamin A was doubled for further 3 days (period III) and in the last period (period IV), the supplement of vitamin A was withdrawn. Milk samples were collected daily from each animal and cream was obtained by mechanical separation. The cream was heated to 115°C. and the clarified fat was assayed for vitamin A by the procedure already reported.⁴ The results are graphically presented in Fig. 1.

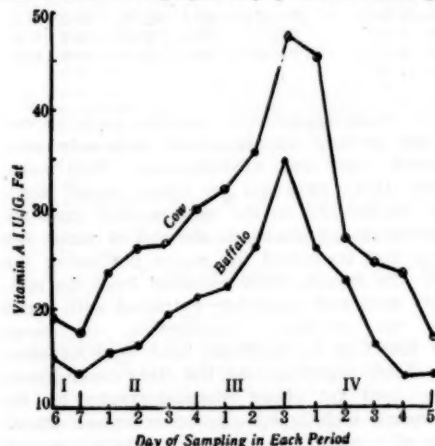


FIG. 1

It can be seen that the feeding of water miscible form increases the vitamin A content of the milkfat and doubling the dosage leads to a further increase. This is true for the vitamin A content of the milk also.

The separated milk was analysed for vitamin A by adopting the method of Koehn.⁵ This method consisted in refluxing 100 g. of separated milk with 100 ml. of alcohol and 50 ml. of 60 per cent. KOH for 10 min. and extracting the solution with ether 3 times. The combined ether extract was completely evaporated and taken up in chloroform for the colorimetric determination of vitamin A in the usual way. By using this method the authors were able to account for practically all the vitamin A in separated milk fortified with water-miscible vitamin A. However, no vitamin A could be detected in any of the skim milk samples obtained during periods II and III when the animals were receiving water-miscible vitamin A. This shows that the feeding of water-miscible form of vitamin A leads to an increase in the vitamin A content of the milkfat only without showing any effect on the skim milk. The water-miscible form is thus converted into oil-soluble form in the animal system.

The authors are grateful to M/s. F. Hoffmann-La-Roche Co., Basle, Switzerland, and their Agents, M/s. Volkart Brothers, Bombay, for generously supplying the vitamin A samples used in this investigation.

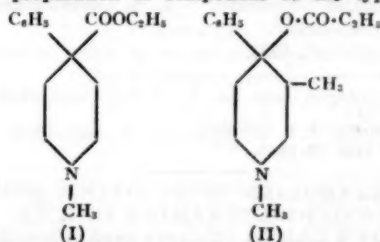
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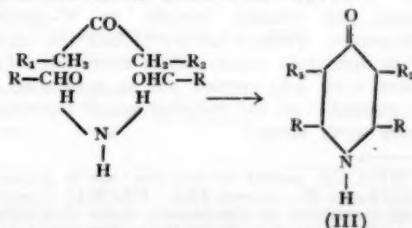
SYNTHESIS OF SOME 4-PIPERIDONE DERIVATIVES

THE discovery that Pethidine (I) (also called Demerol, Meperidine, Dolantin or Isonipacaine) and Nisential¹ (II) are potent analgesics has stimulated great interest in the chemistry of piperidines. In recent years, several piperidine derivatives have been synthesised with a view to examine their pharmacological properties.

The preparation of compounds of the type II



involves the use of 4-piperidones of the type III, and many such compounds have been prepared by employing the method of Noller and Baliah² and are reported herein. The reaction may be schematically represented as below:



The experimental procedure adopted in each case was as follows: a mixture of the ketone (1 mole), aldehyde (2 moles) and ammonium

Hydrochlorides						Bases		
R ₁	R ₂	R	Yield %	M.P. ° C.	Analyses % Cl	M.P. ° C.	Analyses %	
							C	H
H	<i>n</i> -C ₃ H ₇	C ₆ H ₅	42	201-202	10.60 (10.77)	91-92	81.7 (81.9)	7.6 (7.9)
H	<i>n</i> -C ₄ H ₉	C ₆ H ₅	30	224-226	10.48 (10.34)	88-90	81.8 (82.1)	8.2 (8.1)
H	<i>n</i> -C ₄ H ₉	<i>p</i> -CH ₃ OC ₆ H ₄	25	167-168	8.89 (8.80)	..	..	..
H	<i>n</i> -C ₆ H ₁₃	C ₆ H ₅	40	162-194	9.40 (9.55)	110-112	82.2 (82.4)	8.6 (8.7)
H	<i>n</i> -C ₆ H ₁₃	<i>p</i> -CH ₃ OC ₆ H ₄	32	186-187	8.21 (8.22)	94-95	76.4 (76.0)	8.2 (8.4)
H	<i>n</i> -C ₇ H ₁₅	C ₆ H ₅	30	174-175	9.02 (9.21)	74-75	82.0 (82.5)	8.9 (8.9)
H	<i>n</i> -C ₇ H ₁₅	<i>p</i> -CH ₃ OC ₆ H ₄	23	193-194	8.05 (7.97)	..	..	..

acetate (1 mole) in glacial acetic acid (100 c.c.) was heated to boiling and set aside for 12 hours. The addition of ether and hydrochloric acid precipitated the piperidone hydrochloride. It was recrystallised from alcohol-ether mixture. The base was liberated by adding aqueous ammonia to a suspension of the hydrochloride in acetone and pouring the resulting solution into water. It was recrystallised from alcohol. Details regarding the 4-piperidones prepared and of the hydrochlorides obtained are listed in Table I. The quantities within brackets are those calculated from the formula.

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METABOLISM OF NICOTINIC ACID AND NICOTINAMIDE IN RICE MOTH LARVA (*Corcyra cephalonica* St.)

ALTHOUGH the metabolism of niacin has been studied quite extensively in many species of animals, not much is known about the metabolism of the vitamin in insects. Pearson *et al.*¹ have observed that carnivorous mammals excrete the vitamin mainly as N'-methyl nicotinamide, whereas herbivora lack the capacity to methylate niacin before excretion. The present work was carried out as a parallel to our studies^{2,3} on the metabolism of tryptophan in rice moth larva.*

* While the present investigation was in progress, Kato (Kato, M., *Science*, 1953, **118**, 654) reported on the metabolism of nicotinamide in the herbivorous insect, *Bombyx mori*, and in the carnivorous insect, *Lucilia caesar*, L., and demonstrated the absence of N'-methyl nicotinamide in their excretions.

The experimental diet was the same as described earlier,⁴ supplemented separately with nicotinic acid and nicotinamide. Rice moth larvae, 10-12 days old on whole wheat flour, were maintained on the experimental diets for a period of 4-6 weeks, at the end of which the larvae had consumed the major portion of the diet. The excreta were collected from the residual diets and separately extracted with water and the extracts concentrated *in vacuo* and taken up in 50-60 per cent. aqueous ethanol. After centrifugation, the clear supernatants were used for paper chromatography by the ascending technique,⁵ against reference standards of nicotinic acid, nicotinamide, nicotinuric acid and N'-methyl nicotinamide. The organic phase of a mixture of *n*-butyl alcohol, methyl alcohol, benzene and water (2:1:1:1) used by Radhakrishnamurty and Sarma⁶ for the resolution of the B vitamins gave the most satisfactory separation between nicotinic acid and nicotinamide, and hence was employed in the present study. The ternary nitrogen compounds were located on the chromatogram by the method already described⁶ and N'-methyl nicotinamide was detected by the test employed by Reddi and Kodicek.⁷ The R_f values of nicotinic acid, nicotinamide, nicotinuric acid and N'-methyl nicotinamide were 0.42, 0.75, 0.30 and 0.26 respectively.

The results obtained with the extracts of larval excreta showed that N'-methyl nicotinamide was completely absent; on the other hand, the excretory product was nicotinic acid irrespective of whether nicotinic acid or nicotinamide was fed to the larva. This observation indicates that methylation of niacin does not take place in the rice moth larva in contrast to the metabolic pathway in mammals, but that even nicotinamide is deamidated prior to excretion. An enzyme, capable of deamidating nicotinamide stoichiometrically to nicotinic

acid has been found recently in several lactic acid bacteria.⁸

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SUPPLEMENTARY NUTRITIVE VALUE OF SOME SUBSIDIARY CEREALS

DURING recent years unfamiliar cereals such as 'Kodra' (*Paspalum scrobiculatum*), 'Rajgira' (*Amaranthus paniculatus*) and 'Wari' (*Panicum miliaceum*), have been used to supplement the staple food grains like rice and wheat. The supplementary nutritive value of these food-stuffs was studied by the growth and nitrogen balance methods and the results are reported here.

1. *The protein being supplied by the cereals under test and red gram (Growth Method).*—24 albino rats, 40-50 g. in weight, were divided into 4 groups and given a diet containing 8 per cent. protein, of which 3.25 per cent. protein was derived from the different subsidiary cereals under test in each group and the rest was from the pulse red gram (*Cajanus indicus*).

The rest of the diet consisted of 8 per cent. groundnut oil, 4 per cent. salt mixture (Osborne and Mendel), 1 per cent. shark liver oil (containing 1,000 I.U. vitamin A and 100 I.U. vitamin D per gram), the whole being made to 100 g. with starch. Animals were also given 0.1 ml. of vitamin B complex solution containing thiamine 25 mg., riboflavin 20 mg., calcium pantothenate 100 mg., pyridoxine hydrochloride 25 mg. and niacin 100 mg. in 100 ml. Food consumption was recorded daily and animals were weighed twice a week. The results are given in Table I below.

Of the four diets investigated, that containing the proteins of red gram and Kodra was found to have the highest biological value, whereas the Wari-red gram mixture had the lowest biological value.

2. *The protein being supplied by the cereal under test and rice (Nitrogen Balance Method).*—Here adult albino rats weighing 150-70 g. were used. The diets contained 5.68 per cent. of protein, half of which was derived from rice and the other half from the different cereals under test. In all other respects the diets were similar to those used in the growth experiment. The technique employed is similar to that used by Chick *et al.*^{1,2} and Swaminathan.³⁻⁵ The results obtained are given in Table II below.

TABLE II
Biological value of mixed proteins of rice and the subsidiary cereals

Group	Biological value %	Digestibility coefficient
Rice alone	89.8 ± 0.8	86.9 ± 1.1
Rice + Wari	71.8 ± 5.8	90.5 ± 2.3
Rice + Rajgira	86.2 ± 4.2	88.3 ± 1.8
Rice + Kodra	91.5 ± 2.1	89.6 ± 2.4

It is clear from the table that the Kodra-Rice and the Rajgira-Rice diets give almost the same biological values as the rice diet alone. Wari is definitely inferior to the other cereals tested,

TABLE I
Biological values of mixed proteins of subsidiary cereals and red gram

Group	Wt. of rats in g.		Gain in wt. I	Duration in weeks	Food intake in g.	Protein intake in g. P	I./P.
	Initial	Final					
Rice + red gram	43	85	42	11	376	30.08	1.483 ± 0.55
Wari + do	43	68	25	11	378	30.24	0.837 ± 0.23
Rajgira + do	43	81	38	11	372	29.76	1.253 ± 0.45
Kodra + do	43	102	59	11	472	37.76	1.595 ± 0.36

either when supplemented to pulse protein or rice protein.

The authors wish to thank Dr. P. M. Wagle for his interest in the work.

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USE OF GROWTH SUBSTANCES IN THE INDUCTION OF PARTHENO- CARPY IN *LYCOPERSICON ESCULEN- TUM* AND *CAPSICUM ANNUUM*

Two growth substances, phenoxy-acetic-acid (PAA) and indole-acetic-acid (IAA), have been used in this investigation, the former at a concentration of 10 p.p.m. and the latter at two concentrations, 10 p.p.m. and 1 p.p.m. The method of study consisted in emasculating the buds at the pre-anthesis stage in 5 plants under each treatment. The emasculations have been made on 3 dates on all the unopened buds present at each date. In the beginning after emasculating, spraying with the hormone concerned was done thrice a week, but as experience showed that all the sprayed buds dropped off without opening into flowers and forming fruits, showing shrivelling before dropping off, at the later dates after emasculating only one spray application of the hormone concerned was given per week, with better results. A greater percentage of the emasculated and hormone-sprayed buds developed into flowers and fruits by such reduction in the frequency of spraying.

TABLE I
Percentage of parthenocarpic fruits produced
under different hormone treatments

Plant material	PAA 10 p.p.m.	IAA 10 p.p.m.	IAA 1 p.p.m.
Tomato	30	48	50
Chillies	43.8	47	64.7

There is a higher induction of parthenocarpy in the weaker dose of IAA (1 p.p.m.) both in the case of tomatoes and chillies. IAA seems to be relatively more effective than PAA. However, in fruit size PAA and IAA at 10 p.p.m.

on chillies yield distinctly bigger fruits than the control. In tomato PAA (10 p.p.m.) yielded smaller fruits than the control, but IAA (10 p.p.m.) treatment gave bigger fruits. In IAA (10 p.p.m.) treatment fruit size is of the same order as in the control.

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College of Agriculture,
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December 14, 1953.

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CHROMOSOMES OF *SCILLA* *HOHENACKERI* FISCH. & MEY.

DURING the course of a karyological study of the genus *Scilla*, one of the two Indian species, *S. Hohenackeri*, showed certain hitherto unrecorded facts, which are thought to have a bearing on the evolutionary tendencies within the genus.

Fig. 1 represents the somatic metaphase of *S. Hohenackeri* showing 10 chromosomes. The



FIG. 1. *Scilla Hohenackeri*. Somatic metaphase, showing 10 chromosomes (from an aceto-carmin smear preparation of a root-tip material prefixed in 0.2% colchicine and fixed in acetic-alcohol, 1:3).

chromosome number of the species is not known and such a low diploid number has never been recorded for any other species of *Scilla*.² The chromosomes are fairly large with a distinct morphology. The diploid complement consists of two pairs of chromosomes with either median or submedian constrictions and three pairs of chromosomes with subterminal constrictions.

It is indeed remarkable that such a karyotype with the lowest chromosome number so far reported in the genus is asymmetrical. This fact becomes more evident when the chromosome complement of this species is compared with that of *S. siberica* ($2n = 12$), which is characterised by medianly or submedianly constricted chromosomes, and never with subterminal constrictions. This raises the problem of

the evolutionary relationship of *S. Hohenackeri* to the other species.

The second Indian species, viz., *S. indica* is now known to exist in 5 distinct so-called "chromosome races" having $2n = 30^4$, 44, 45, 46⁵ and 58⁵ chromosomes. Interesting is the fact that $2n = 30$, which is the lowest number in *S. indica*, represents a multiple of five, which is the haploid number of *S. Hohenackeri*. Apparently, this chromosome number relationship establishes a certain degree of affinity between the two Indian species.

The writer is thankful to Prof. A. C. Joshi and Dr. R. Misra for the kindly interest, and to Prof. R. Stewart for the bulbs of *S. Hohenackeri*.

Dept. of Botany,
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Sagar (M.P.),
November 11, 1953.

Y. SUNDAR RAO.

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SUGARCANE RATOONS

RATOONING of sugarcane is a common practice among cane-growers, and is usually adopted owing to its comparative cheapness in cultivation. However, under similar conditions, ratoons are found to come upto maturity earlier and yield less than plant crop. It has been stressed that the yields of ratoons could be raised by bestowing greater care in their culture and nutrition.^{2,4} Nagar reported a gradual increase in the yields of the first, second and third ratoons of Co. 312 at Shahjahanpur when nitrogen was applied at 100 lb. per acre.³ Considerable work was done on this aspect in the Sugarcane Ratooning Scheme at Kalai in U.P.; heavier manuring of ratoons was found not only to reduce insect-attack, but raise the extraction of juice.¹

A comparative study of the performance of the plant crop and the first two ratoons of Co. 419, all receiving a manurial dose of 100 lb. nitrogen per acre, was made on this Station during 1947-50; and detailed investigations were carried out in respect of plant nutrition and development, effects on soil composition, and the ultimate yield and juice quality.

The yield of cane and sugar per acre was found to be higher for the plant crop than the

ratoons, the second ratoon recording the lowest values. The ratoons attained maturity earlier, and recorded better juice quality. The yield of the first ratoon could be pulled up to the level of the plant crop by increased nitrogen application (150 lb. nitrogen per acre), but no similar response was observed in the case of the second ratoon. Phosphatic manure application tended to show slight beneficial effect on cane yield when response to nitrogen was limited, as in the case of the second ratoon.

The chief difference between the plant crop and the ratoons noted was that the nutritional level of the plant crop in respect of nitrogen, as revealed through foliar and whole-plant analysis, was of a higher order than the ratoons. The plant crop had a higher nitrogen-uptake during the growth-phase. The over-all nutritional status in respect of N, P and K was lowest for the second ratoon. Correspondingly, the soil under the ratoons contained lower nitrogen. This may be due in part to the fact that the soil does not have a fallow period for recuperation of nitrogen, since the ratoon immediately follows the plant crop. No other broad differences in the soil composition under plant and ratoon crops were noticed in respect of pH, total soluble salts, mechanical composition, exchangeable calcium and available phosphoric acid; but the organic carbon and available potash tended to show an increase with ratooning. The ratoons showed a lower hydration of the plant tissue than the plant crop, and this seemed to induce earlier maturity in the ratoons as reported.

A detailed paper embodying the various items of study including the results of soil and plant analysis, has been sent for publication elsewhere.⁵

The investigations were conducted in a scheme partly financed by the Indian Central Sugarcane Committee, New Delhi, to whom our thanks are due.

Chemical Laboratory, N. V. MOHANA RAO.
Sugarcane Res. Station, R. L. NARASIMHAM.
Anakapalle,
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MORPHOLOGY AND EMBRYOLOGY OF *HELICANTHES ELASTICA* (DESR.) DANS.

THE subfamily Lorantheae has been considered to be of great interest because of the variations in the development and organisation of the embryo sac, endosperm and embryo. Although there are more than 50 genera distributed in the tropics, detailed work is limited only to *Dendrophthoe* (Rauch,⁶ Singh⁸), *Scurula* (Rauch⁶) and *Macrosolen* (Maheshwari and Singh⁸). Some other genera have also been studied but the observations are by no means complete (see Pienaar,⁵ Schaeppi and Steindl,⁷ Smart⁹). In this laboratory Narayana⁴ and Dixit² have been working on *Lysiana* and *Amyema* respectively. So far there has been no work on the genus *Helicanthes*.

Nearly 8-15 bracteate, sessile, pentamerous flowers are aggregated in a whorl at each node. Open flowers measure 30-43 mm. in length and show a conspicuous 2 mm. long calyculus. The stamens are epiphyllous and adnate for about one-third the distance. The vascular supply of the flower conforms to a pentamerous plan. The calyculus is without any vascular supply.

Microsporogenesis follows the usual course. The reduction divisions are simultaneous and tetrahedral tetrads are formed. The pollen grains are triangular with one germ pore at the tip of each of the three arms. They remain two-celled at the time of shedding. Occasionally 4-rayed pollen grains were also observed.

The narrow stylar canal is continuous with the ovarian cavity which encloses a nipple-shaped mamelon (Figs. 1, 2). Three to five layers below the mamelon differentiates a saucer-shaped collenchymatous pad (Figs. 1-4, c). The entire hypodermal tissue of the mamelon, comprising 30-40 cells, becomes sporogenous (Fig. 2) and several of the cells elongate to give rise to megaspore mother cells which undergo the usual reduction divisions to form linear tetrads (Fig. 4). One or more megaspores of the same tetrad as well as megaspores of other tetrads enlarge and become vacuolated. Thus about a dozen or more embryo sacs are produced (Figs. 5-15). There is widespread degeneration of many cells of the sporogenous tissue and its derivatives.

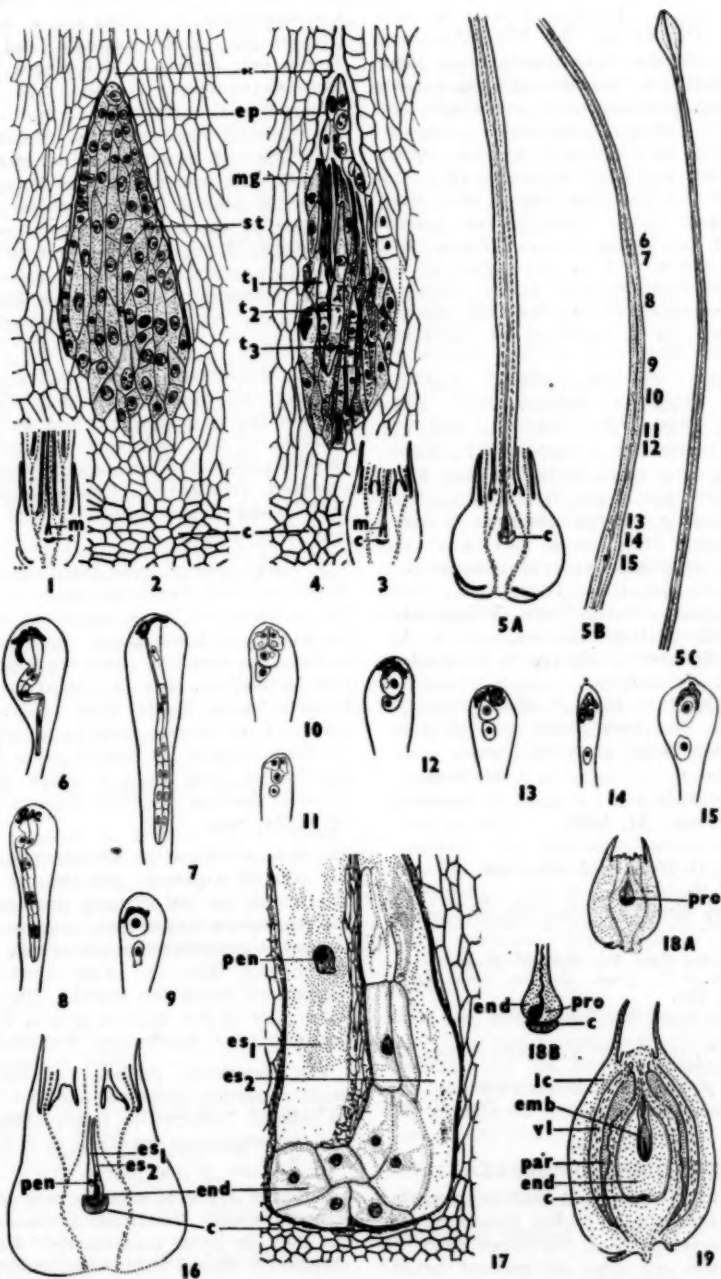
Due to the growth of the embryo sacs the epidermal layer of the mamelon as well as that of the ovarian canal is completely crushed. The embryo sacs make their way upwards through the stylar tissue and as many as 9-12 of them come to lie in the stylar canal (Figs. 5-15). They extend up to about half the length of

the style and clearly show the egg apparatus and the upper polar nucleus. In a 40 mm. long carpel the shortest organised embryo sac measured 4 mm. while the longest measured 16 mm. The lower ends of the embryo sacs are embedded in a mass of degenerated tissue and make their way down to the collenchymatous pad.

Polar fusion occurs in the upper part of the embryo sacs and the fusion nucleus lies adjacent to the egg (Fig. 10). After fertilization the primary endosperm nucleus travels down to the basal part of the embryo sac where it divides to form Cellular endosperm (Figs. 16, 17). Endosperm formation occurs simultaneously in several embryo sacs and the ovarian cells separating the individual embryo sacs are gradually crushed and consumed. Finally the endosperms come close to one another and fuse to form a composite mass (Figs. 18 A, B; 19).

The first division of the zygote is longitudinal but further divisions are transverse and result in a biseriate proembryo (Figs. 6-8). The earlier divisions take place in the stylar canal but the proembryo soon enters the stylar tissue. Several proembryos, from different zygotes, develop in the same style and in one case we counted as many as twelve. The cells of the suspensor continue to divide and elongate until the proembryo reaches the lower end of the embryo sac, growing down as far as the collenchymatous pad (Figs. 18 A, B). Mean-

FIG. 1. L.S. ovary showing mamelon at the time of differentiation of sporogenous tissue (diagrammatic), $\times 8$. FIG. 2. Mamelon *m* in Fig. 1 enlarged with adjacent ovarian tissue to show sporogenous cells (reconstructed from several sections), $\times 190$. FIG. 3. L.S. ovary showing mamelon at megaspore tetrad stage (diagrammatic), $\times 8$. FIG. 4. Mamelon *m* in Fig. 3 enlarged with adjacent ovarian tissue to show megaspore tetrads (reconstructed); the outer walls of megaspores comprising the tetrads have been drawn a little thicker to demarcate them from the surrounding tissue, $\times 190$. FIG. 5. L.S. carpel: *A*, *B* and *C* represent the lower middle and upper portions respectively (diagrammatic), $\times 8$. FIGS. 6-15. Upper ends of ten embryo sacs situated in the style shown in Fig. 5 B, $\times 124$. FIG. 16. L.S. ovary showing primary endosperm nucleus in lower part of the embryo sac; the mamelon has degenerated (diagrammatic), $\times 12$. FIG. 17. Enlarged view of embryo sacs shown in Fig. 16, $\times 141$. FIG. 18 A. L.S. ovary showing terminal part of proembryo surrounded by composite endosperm (diagrammatic), $\times 6$. FIG. 18 B. Endosperm and proembryo enlarged, $\times 17$. FIG. 19. L.S. young fruit showing dicotyledonous embryo (diagrammatic), $\times 6$. *c*—collenchymatous pad, *emb*—embryo, *end*—endosperm, *ep*—mamelon epid.-mis, *er*—embryo sac, *lc*—leathery coat, *m*—mamelon, *mg*—megaspore mother cell, *oc*—ovarian cavity, *par*—parenchymatous tissue, *per*—primary endosperm nucleus, *pro*—proembryo, *st*—sporogenous tissue, *t*—tetrad, *vl*—viscid layer.



while the terminal embryonal cells divide repeatedly to form a club-shaped mass of cells from which differentiate the two cotyledons. The swollen radicular end organises much later.

The ripe fruit is a "pseudoberry" and consists of three main parts—pericarp, endosperm and embryo. The pericarp comprises 4 zones—an outer leathery coat followed by the viscid, parenchymatous and vascular layers (Fig. 19). The endosperm is vase-like with a solid truncated basal part and a wider, hollow, 5-lobed upper region enclosing the cotyledons. The latter are fused except in the region of the plumule. The radicular end, which represents only the extension of the hypocotyledonary region, closely fits at the apex of the endosperm.

The ovaries of *Dendrophthoe*, *Scurrula*, *Helixanthera*, *Taxillus*, *Barathranthus*, *Tapi-nanthus* and *Tupeia* show extreme reduction and there is no trace of a mamelon. In *Macrosolen*, on the other hand, there is a well developed mamelon with three basal lobes. *Helicanthes elastica* is intermediate since it has a conical mamelon but this is devoid of any basal lobes. Therefore, Danser's¹ assignment of *Helicanthes* to the tribe Loranthae, which includes *Scurrula*, *Dendrophthoe*, *Helixanthera*, etc., is considered unsatisfactory. It is suggested that *Helicanthes* should be assigned to a new tribe, *Helicantheae*.

We are obliged to Prof. P. Maheshwari for his interest in this investigation and for allowing free access to his personal library.

Dept. of Botany,

University of Delhi,

Delhi 8, December 31, 1953.

B. M. JOHRI.

J. S. AGRAWAL.

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EMBRYO SAC OF SCILLA

As early as 1880 Treub and Mellink⁴ reported that in *Agraphis patula* (*Scilla hispanica*) the embryo sac develops from the upper dyad cell while the lower one does not proceed beyond the 4-nucleate stage. Similar observations have

been recorded for several other species; *S. campanulata*, *S. nutans* and *S. hyacinthoides* (Guignard⁴); *S. campanulata* and *S. hyacinthoides* var. *cœrulea* (McKenney⁵); *S. sibirica* (Schniewind-Thies⁴); and *S. nonscripta* (Hoare³). On the other hand, Govindappa and Sheriff¹ have recently reported that in *S. indica* the embryo sac is monosporic, 8-nucleate and conforms to the Polygonum type. To decide whether the embryo sac is mono- or bisporic, it was considered worthwhile to re-investigate *S. indica* Baker and as some material of *S. hyacinthina* Bach. (collected from the Bogor Botanical Gardens) was also available, opportunity was taken to investigate both the species.

The observations on *S. indica* confirm the findings of Govindappa and Sheriff. The embryo sac is monosporic and 8-nucleate. In addition, a few polyploid 4- and 8-nucleate embryo sacs in the same species have also been observed. The polyploid embryo sacs and their nuclei were almost double the size of the normal embryo sacs.

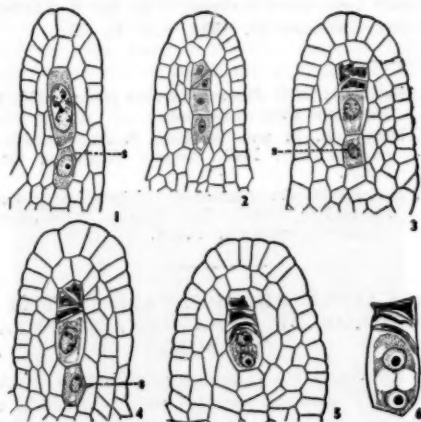
S. indica has a wide distribution in India. Raghavan and Venkatasubban⁶ have reported the existence of three aneuploid races ($2n = 44, 45, 46$) in South India. According to these authors the first two races are morphologically indistinguishable but the third has distinctly broader leaves. Sunder Rao⁶ reports the existence of a fourth race from Sagar with 58 somatic chromosomes. In this case the leaves show blotches of dark green to black colour. The material showing polyploid embryo sacs belonged to this race.

In *S. hyacinthina* the hypodermal archesporial cell cuts off a parietal cell (Fig. 1). Occasionally a nucellar cell situated immediately below the megaspore mother cell enlarges in size and somewhat simulates the appearance of a sporogenous cell (Fig. 1). Figs. 3 and 4 show a similar cell below the tetrad. The vacuoles on either side of the nucleus give it the false appearance of a functioning megaspore.

The megaspore mother cell undergoes the usual reduction divisions and the tetrad may be oblique, T-shaped or linear (Figs. 2-6). The chalazal megaspore functions as is evident from Figs. 3-6.

Different types of embryo sacs are not very common within the limits of the same genus but they do occur occasionally. *Nothoscordum* (Messeri⁴) shows Polygonum and Allium types of development while *Erythronium* (Haque²)

shows both *Fritillaria* and *Adoxa* types, *Tulipa* is similar to *Erythronium* in this respect (Bambacioni and Giombini³; Bambacioni-Mezzetti,⁴ Simoni,⁴ and Romanov⁴).



FIGS. 1-6. *Scilla hyacinthina*, Fig. 1. L. S. nucellus showing a megaspore mother cell followed by a sporogenous cell *s*. $\times 155$.

FIG. 2. Tetrad of megaspores. $\times 155$.

FIGS. 3-5. Same, showing functioning megaspore. The non-functional sporogenous cell is marked *s*. In FIG. 4, the third megaspore from the apex shows two degenerated nuclei. In Fig. 5 the nucleus of the functional megaspore has already divided. $\times 155$.

FIG. 6. 2-Nucleate embryo sac. $\times 250$.

It would be of interest to check up other species of *Scilla*.

It is a pleasure to express my gratitude to Prof. P. Maheshwari and Dr. B. M. Johri who suggested the problem and guided the work. Thanks are also due to Mr. H. R. Bhargava (Sagar) for providing the material of *Scilla indica* on which a part of this investigation is based.

Dept. of Botany,
University of Delhi,
Delhi, January 8, 1954.

SULBHA.

RAPID VOLUMETRIC METHOD FOR THE ESTIMATION OF NICKEL

THE method was tried with stock solutions of nickel sulphate (5 per cent.) and nickel chloride (2 per cent.). The standard solution of dimethyl glyoxime was prepared by dissolving 2.90 g. of the substance in alcohol and the solution was made up to 500 ml. with alcohol-water mixture, sufficient alcohol being used to get a clear solution. 25 ml. of the stock solution was diluted to 250 ml.

25 ml. of the diluted solution was treated with dilute ammonium hydroxide (till a turbidity appeared or a blue solution was formed). It was then acidified with acetic acid (slight excess). Dimethyl glyoxime solution was then run into this solution 1 ml. at a time (pilot reading), the end point being determined as shown below.

A drop of the reaction mixture was filtered through a strip of filter-paper on to another filter-paper. The red precipitate remained on the first filter-paper and a colourless solution was spotted on the second filter-paper. A drop or two of dimethyl glyoxime was placed on this spot and the colour developed was noted. The disappearance of the red colouration showed the end point. For further readings, dimethyl glyoxime solution was run into the nickel solution within 0.50 ml. of the pilot reading. The reaction mixture was then heated on a water-bath for about 3 minutes and further addition of dimethyl glyoxime was carried out (2 drops at a time), noting the colouration as shown above, till the end point was reached. The final readings can be taken accurate to 0.20 ml. The results compared very favourably with those obtained by the gravimetric method using dimethyl glyoxime in the usual manner, the methods giving values agreeing to within 0.2 per cent. on the same solution.

It was also found that the presence of silver, zinc, iron and chromium ions does not affect the accuracy of the method. Because of colour development, the method cannot be used, as it is, to estimate nickel in the presence of copper and cobalt ions.

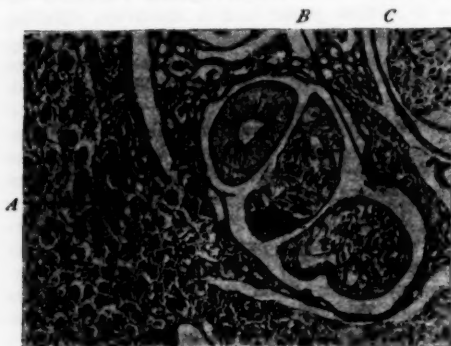
Dept. of Chemistry, SHARAD D. PISHAWIKAR.
Rajaram College, D. G. PISHAWIKAR.
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AN UNUSUAL RECORD OF A NEMATODE IN AN AVIAN KIDNEY

MATERIALS from an Indian Emerald Dove (*Chalcophaps indica indica*) which died of unknown causes have been sent by the authorities of the Zoological Gardens, Bombay, to the Bombay Veterinary College for histopathological examination and report. These consist of pieces from liver, kidney and intestines. The intestine pieces were opened up and found to contain a number of tapeworms belonging to *Raillietina* spp. and round worms belonging to *Ascaridia* spp. Besides these, a few minute, slender, hair-like nematodes which were indistinguishable from *Ornithostrongylus quadri-radiatus*, a parasite which is not uncommonly the cause of losses in pigeons and doves, were also present.

During the histopathological examination of the tissues we discovered a number of nematode eggs in transversely cut gravid parasites embedded in the parenchyma of the kidney sections (see microphotograph). The presence



Microphotograph of the kidney section showing the parasite

- A. Kidney parenchyma showing tubules and glomeruli.
B. A transverse section of the parasite showing gravid uterus and intestine.
C. A transverse section of a portion of the parasite through the gravid uterus.

of the parasite with fully developed eggs in an avian kidney was quite surprising as it was not reported in literature so far. Worms in the kidney are generally seen in pigs (*Stephanurus dentatus*) and dogs (*Diectophyme renalis*). The parasite in the kidney could not be studied entire as only a small piece of kidney was available and only a few sections could be cut for histopathological examination.

The findings of the nematode in an Avian kidney is quite unusual and it would be interesting to find out if this is quite common, and if so, what the species involved are.

Bombay Veterinary College, R. M. KALAPESI.
Bombay, January 21, 1954. S. R. RAO.

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ALKALINE PHOSPHATASE IN THE NEPHRON OF *RANA HEXADACTYLA* (LESSON)

THE distribution of alkaline phosphatase in the vertebrate kidney has formed a subject of study by a number of workers since Gomori's report¹ of its occurrence in the glomeruli of the cat. It has generally been found that the proximal convoluted tubule, especially the brush border, shows pronounced phosphatase activity in a number of animals,^{2,4,5,9} while the glomerulus is ordinarily devoid of it or shows only faint indications of its presence. Under pathological conditions, however, as in choline deficiency⁵ in the rat, the glomerulus shows intense phosphatase activity while there is a significant decline in the convoluted tubule. Similarly, in diabetic rats, Kar and Ghosh² observed a great concentration of the enzyme in the glomerulus, though Soulaireac⁸ had earlier reported the complete disappearance of renal phosphatase from the nephron of diabetic rats. These observations have afforded confirmation of the concept prevailing in recent years that the actual absorption of "threshold substances" such as sugar and sodium chloride takes place in the convoluted tubule, while the function of the glomerulus was one of simple mechanical filtration. This difference between the functions of the two parts of the nephron was reflected in the marked difference between the phosphatase activity exhibited by them. Even in cases where the glomerulus showed a positive reaction, it was significantly less than that in the convoluted tubules.

During a recent study of the occurrence and distribution of alkaline phosphatase in a variety of animals under different conditions, it was discovered that the common frog, *Rana hexadactyla* displayed a condition which seemed

interesting. Employment of Gomori's technique showed that under normal conditions, the glomeruli display a pronounced reaction and stand out prominently as regions where perhaps the phosphatase activity is most intense. The proximal convoluted tubule of the nephron also gave a positive reaction but it was not as intense as in the glomerulus. Incubation in the substrate was done for 9 hr. 45 min. which, by experience with this material, is the minimum required for the reaction.

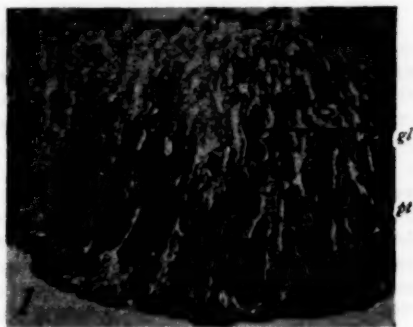


FIG. 1. Transverse section through the kidney of frog, showing pronounced alkaline phosphatase reaction in glomeruli. $\times 50$. *gl.*: glomerulus. *pt.*: proximal convoluted tubule.

The above observation appears to call for a re-orientation of our ideas in regard to renal physiology. The theory of renal excretion originated by the Ludwig school and extended by others in recent years is that the function of the glomerulus is one of mechanical filtration, the energy for which is furnished by blood pressure.⁷ As the glomerular transudate passes down the tubule, sugar and sodium chloride are absorbed. During choline deficiency⁸ and after bilateral adrenalectomy⁹ the nephron of the rat, in striking contrast with the normal animal, shows intense activity in its glomerulus while the convoluted tubule displays a paucity of the reaction. A similar situation is seen in diabetic rats where Kar, Banerjee and Ghosh⁵ reported intense activity in the glomerulus and its almost complete absence in the convoluted

tubule.⁸ Such a change in the distribution of alkaline phosphatase might possibly be a device for efficient elimination of excess of glucose from the blood; for, the proximal convoluted tubule, judged by the absence of the enzyme, has lost much of its absorptive function, while the glomerulus with its abundant phosphatase activity has taken the role predominantly of a secretory organ. It is significant that the normal condition is restored after insulin therapy.⁸

The occurrence, normally, of alkaline phosphatase in the glomerulus of the frog's kidney would also seem to indicate a situation somewhat analogous to the pathological conditions in the rat. Perhaps in both cases, there is a more rapid secretion of threshold substances by the glomerulus. It seems to indicate that originally the glomerulus performed the functions of both mechanical filtration and secretion, but that during the course of evolution it has lost the latter in many vertebrates, though still maintaining the potentialities for enzymatically controlling the output of the filtrate.

We wish to thank Prof. B. R. Seshachar for his guidance and suggestions. Our thanks are due to Mr. M. M. Veerabhadraiah, for his help in photomicrography, and to the Ministry of Education, Govt. of India, for the award of a Senior Research Fellowship to one of us (V. K. S. I.).

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January 29, 1954.

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REVIEWS

Table of Natural Logarithms for Arguments Between Zero and Five to Sixteen Decimal Places. NBS Applied Mathematics Series 31. (Govt. Printing Office, Washington 25, D.C.). Pp. 501. Price \$ 3.25.

This table is made available to meet a continuing demand for sixteen place tables of logarithms of numbers from .0001 to 5 at intervals of .0001. It is a re-issue of Volume III of a four-volume table of logarithms published in 1941.

Logarithms are among the most common mathematical functions. Since four-figure arguments are often sufficient in practice, the practical computer in mathematics, physics and engineering should find this table very labour-saving in view of the fine interval. Whenever the logarithm of a number given to more than 4 places is needed, linear interpolation is usually satisfactory because it gives approximately nine decimal place accuracy over the range of the table.

Fluorescence of Solutions. By E. J. Bowen and Frank Wokes. (Longmans, Green & Co., London), 1953. Pp. 92. Price 25 sh.

The book under review forms an elementary introduction to the subject of fluorescence of solutions. It contains a brief account of the processes of light absorption and emission, of the factors influencing fluorescence, the kinetics of fluorescence quenching and the methods of fluorescence excitation and measurement. It is divided into ten chapters which deal respectively with the following topics: (I) Fluorescence compared with other radiation; (II) Energy considerations; (III) Fluorescence and modern theory of wave mechanics; (IV) Instrumental factors affecting fluorescence; (V) Theoretical concepts of quenching; (VI) The kinetics of quenching processes; (VII) Detection of fluorescence; (VIII) Fluorimeters; (IX) Measurement of fluorescence; and (X) Fluorimetric assays.

In the monograph under reference the author has laid more emphasis on the experimental than the theoretical aspect of fluorescence. He has, however, brought out some of the highlights of fluorescence theory without giving detailed mathematical proofs. A major portion of the book has been devoted to the practical side of fluorescence measurements and inter-

pretation. The principles and apparatus used for fluorescence excitation and measurement have been described in some detail. An account has also been given of the construction and use of commercial fluorimeters and of the methods of evaluating the results.

Students who want to acquire an elementary knowledge of the subject of fluorescence and the methods of measurement will find this book very useful. To those engaged in the identification and estimation of small concentrations of fluorescent materials, the book will be very helpful for getting the correct interpretation of the results.

R. S. K.

Experimental Inorganic Chemistry. By R. E. Dodd and P. L. Robinson. (Elsevier Publishing Co.), 1954. Pp. xii + 424. Price 42 sh.

This publication is "a guide to laboratory practice" for the benefit of students who are to be initiated to research in inorganic chemistry. The seven chapters dealing with "general basic techniques", "the handling of gases", "preparation and purification of gases and volatile compounds", "water, alkalies, acids, solvents", "colloids and disperse systems", "physical methods", and lastly "literature, presentation, safety" give in "a compact form a body of information which may be required at short notice in a laboratory". Every statement is fully documented, and hence its prior use would result in a substantial saving of time in the chemical library.

The literature references numbering 765 are in serial order but distributed at the end of each chapter, and the page references are repeated on each page. The particular advantage in this pagewise repetition is not clear.

Two misprints were noticed, one on the very first page, line 6, "conductes" for "conducted", while the other relates to the index reference on boric acid on p. 417, which should read 282 and not 268. The formula for polythionic acids (p. 289) $H_2S_nO_6$ would be less confusing if printed as $H_2S_xO_6$.

The advice given in the last chapter under "recording results and presentation" would be wholeheartedly endorsed by every teacher and supervisor of research. Sample these: "Ideally the laboratory journal should be intelligible to others who might be required to continue unfinished work and, ideals apart, it must be

intelligible to its author ten years afterwards." "Do not despise an English grammar, and use regularly an English dictionary." "Suspense is out of place in a scientific communication."

The value of the book would have been enhanced if a few typical problems for research had also been suggested or some of the unsolved problems in inorganic chemistry mentioned.

The volume can be strongly recommended to every novice in inorganic research as well as to every one interested in the subject, and every chemistry library should have a copy on its shelf for ready reference. M. R. N.

Physiological Approach to the Lower Animals.

By J. A. Ramsay. (Cambridge University Press), 1952. Pp. v + 148. Price 15 sh. net.

A very noticeable trend in the biological sciences in recent years has been the shift of the emphasis from the purely morphological to the physiological and experimental studies of animals. While the mammalian and in particular human physiology has received the maximum attention, the author rightly points out that a proper understanding of the functional systems of the lower animals is essential before the students can appreciate that man himself is only 'a highly tuned physiological machine carrying out with superlative efficiency what the lower animals are content to muddle through with'. The author has stated in the preface that the book is not intended to be either a text-book of comparative physiology or much less a book of reference. But as an introduction to the subject of the physiology of lower animals, at the upper forms of school and the first year at the Universities, the scope is sufficiently wide and the treatment simple and clear. The author presumes that the reader has a basic knowledge of physics and chemistry and restricts his illustrations to such common types of lower invertebrates as are specified for the more advanced school-leaving examination in England, as recommended by the Cambridge Committee.

The various physiological problems such as digestion, circulation, respiration, excretion and so on are first set forth at the biochemical level and the author has in a simple and lucid manner shown how these problems are solved by the animals, at various levels of structure, in different ways, according to their size, organisation and mode of life.

The text is well written and fully illustrated with simple line drawings and the printing is excellent. The book is heartily recommended

as eminently suitable for the use of the undergraduate biology students of our Universities as an excellent introductory approach to the physiology of the lower animals.

P. N. GANAPATI.

Animal Nutrition Research in India. By K. C. Sen. (Published by Macmillan & Co., Ltd.), 1953. Pp. xii + 370. Price Rs. 15.

The above monograph by Dr. K. C. Sen, is one of the series of publications issued by the Indian Council of Agricultural Research. It describes the results obtained by research workers in India and compares them with similar work in other countries. In accordance with the original recommendations of Sir John Russel, on the work of the I.C.A.R., the purpose of this volume is to make the results of research known to a wider public.

The author of this monograph is a well-known pioneer in organising animal nutritional research in India for more than three decades. The vast amount of experimental results obtained in the last 40 years has been critically examined and compared by him and the conclusions drawn will be of great help to future workers. The results obtained by Indian workers in foreign laboratories have also been included.

The book is divided into 11 chapters of which the first one gives a general introduction providing the background for the other scientific studies. The cultivators in India depend mainly on the by-products of human foodcrops for the feeding and nutrition of their livestock. Very little effort has been made to grow special foods for animals, it is stated, by which the prevailing under-feeding and malnutrition could be prevented. The chemical composition of Indian feeding stuffs is described in Chapter 2. The techniques employed and the various factors influencing the composition of plant materials are considered in detail. The digestibility and nutritive value of Indian feeding stuffs are dealt in Chapter 3. Most of the work done concerns the bovines and the feeding values of rations for cattle and buffaloes are discussed. Chapter 4 describes protein, sulphur and energy metabolism of animals. The work on mineral metabolism of cattle is discussed in Chapter 5. The conservation and processing of fodders and the use of certain plants and tree leaves as scarcity fodders are given in Chapter 6. Silage making is shown in Chapter 7, to be more suitable for this country than other methods of conservation adopted in other countries. The molasses and bago molasses, the

industrial by-products, are stated to improve very much the deficient village ration for work bullocks, in Chapter 8. Poisonous plants and vitamins and deficiency diseases are described in Chapters 9 and 10 respectively. In the last chapter (II), in addition to the nutrition of milch animals and its effect on their production, a fairly complete account of all the investigations carried out on other aspects of dairy research has also been given to make this part of the review complete.

The numerical data of research have been summarised in 99 tables and 22 illustrations are given. At the end of each chapter, a well classified list of references upto 1948 is found. A glossary of native words for fodders with their Latin equivalents and a classified author index at the end, facilitate easy reference. The neat execution and fine printing of the manual by Macmillan & Co., add value to the results reported.

V. MAHADEVAN.

Ayurvedic Flora Medica, Part I. By Vayasakara N. S. Mooss. (Published by Vaidyasarithi, Kottayam), 1953. Pp. 128. Price Rs. 12.

Pharmacognosy of Ayurvedic Drugs, Series 1, No. 2. (Travancore-Cochin.) (Published by the Central Research Institute, University of Travancore, Trivandrum), 1953. Pp. iii + 104.

Indian Pharmaceutical Codex, Vol. I. (Indigenous Drugs). By B. Mukerji. (C.S.I.R. Publication, New Delhi), 1953. Pp. x + 431. Price Rs. 12.

Ayurvedic Flora Medica deals with 40 medicinal plants arranged alphabetically according to genera from *Abrus precatorius* to *Vitex negundo*. The emphasis on botanical names is proper because research workers all over the world can easily trace the plant without any ambiguity regarding identification. The author has to be congratulated on the care he has taken to get the plants properly identified by taxonomic experts.

The author mentions in the preface the paucity of works containing detailed descriptions of Ayurvedic medicinal plants. Kritikar and Basu have done yeoman work in this field as also Nadkarni. The trail blazed by them is to be followed and this book is a good attempt in that direction.

It would have added considerably to the value of this work if the synonyms in the other regional languages had been given and if a common comprehensive index had been included.

The book would be useful in the pharmacognosy of Ayurveda and to the students of Ayurvedic materia medica.

No. 2, Series I, of the *Pharmacognosy of Ayurvedic Drugs* describes 15 plants and their parts, covering 11 drugs. It is well and profusely illustrated.

Pharmacognosy, as far as Ayurveda is concerned, may be taken as a new science because, as mentioned in the preface, 'verses from the works of Caraka, Susruta and Vagbhata do not give much information of pharmacognostic value'.

In ancient days, the practitioner himself collected and preserved the herbs used by him. But in modern conditions such a course is obviously out of the question. A modern Ayurvedic practitioner has to rely on the supplies of herbs through persons who are not specially trained in any of the technical aspects of their trade. Again, there are not many reputed pharmacists. Under these circumstances it is incumbent on the part of the Ayurvedic physician to be able to separate the wheat from the chaff: considerable help in this direction can be obtained from this book.

While rightly the histological features are given in detail, some attention could also have been paid to the floral parts. The chemical notes which are to be published as an appendix to this work, will no doubt serve to enhance the value of this book, and are eagerly awaited.

The Council of Scientific and Industrial Research has laid the scientific public in general and the Ayurvedic scientists in particular, under a deep debt of gratitude by the publication of the *Indian Pharmaceutical Codex* under review. The *Codex* will serve as a source-book to medical botanists, Ayurvedic scientists and such enlightened non-Ayurvedic medical men as are willing and able to exploit for the benefit of mankind, the enormous resources and potentialities of Ayurveda which has stood the test of time. As Col. Chopra in his introduction says, 'Several items of the vegetable materia medica are well worth recognition not only because they have been popular in local therapeutics for a long time, but also because modern research in their active principles have (Sic.) lent a strong support to their being useful in several disease conditions'.

Part I in 256 pages carries general monographs on a number of drugs alphabetically arranged, commencing with *Abroma* and ending with *Zingiber*. Each of these monographs is well written and is worth a detailed study, remembering that there is yet much work to be done regarding identification, chemical composition and pharmacology.

Part II has 125 pages and gives a number of preparations of these drugs with the idea of bringing about some uniformity in the preparation of these medicaments. The value of this part would have been considerably enhanced if a recognised authority on Ayurveda had been included in the Pharmaceutical and Drugs Research Committee.

K. S. RANGANATHAN.

An Introduction to Electronics for Physiological Workers. By I. C. Whitfield. (Macwilliam & Co., Ltd., London), 1954. Pp. 236. Price 18 sh.

Electronic instruments have now become part of the routine equipment of medical men and physiologists generally as diagnostic aids, but occasionally as therapeutic agents. Many doctors would welcome a manual which gives an idea of the principles governing the working of these versatile instruments without having to wade through much technical jargon. This handy book is intended for such men and it serves the purpose admirably.

The book begins by giving a brief account of the fundamental laws of direct and alternating current circuits and circuit elements. This is followed by chapters on thermionic emission and thermionic tubes including gas-filled tubes, photoelectric cells, photo-multipliers, cathode-ray oscillographs, and their characteristics. An elementary but adequate account of the various functions which a thermionic tube can satisfactorily perform, such as rectification, amplification, oscillation, filtering, stabilization, triggering, balance control, etc., is given in half-a-dozen short chapters. Principles of the measures adopted for reducing noise and interference are also dealt with adequately.

The author deserves to be commended for his elegant and easy style of presentation of the subject, which includes a few illustrative numerical problems that are worked out in the text itself. Such problems help the reader to gain an insight into the principles of 'compromise' that are so essential a feature of all practical instrument designs. Analogies such as muscle stretch-receptor and proprioceptive afferents introduced to familiarize the reader with the feed-back principle in amplifiers are very helpful.

Fig. 9, 4 on p. 98 may perhaps mislead the non-technical reader for whom this book is primarily written. This figure gives the impression that flat frequency response over a

wide range can be realized with negative feed-back without any reduction in amplification. This is not quite correct. It is true that in the text itself expressions are given for amplification with and without feed-back which imply that amplification is automatically reduced with negative feed-back, but in the figure explicit mention of this important fact is not made in words. In a book intended for the biologist and the doctor, one feels that such explicit mention is essential.

The volume is fully illustrated with explanatory figures and is nicely got up. It deserves to find a place on the bookshelves of every biological and medical library.

M. V. GOVINDASWAMY.

Biological Transformations of Starch and Cellulose. Edited by R. T. Williams. (Biochemical Society Symposia, No. 11.) (Cambridge University Press), 1953. Pp. 84. Price 10 sh. 6 d.

The book under review is a collection of papers communicated to the Biochemical Society's Symposium held at the London School of Hygiene and Tropical Medicine in February 1953. After a brief introduction by Stanley Peat, a fairly complete survey of the various aspects of biological synthesis of starch is given by E. J. Bourne. This is followed by an article on the enzymic breakdown of starch by W. J. Whelan and another on starch synthesis and degradation *in vivo* by Helen Porter. Cellulose and cellulases are discussed in the next two articles by G. O. Aspinall and M. V. Tracey respectively, while the two concluding articles are of special interest, in that A. T. Phillipson deals with the digestion of cellulose by ruminants and R. G. Fargher discusses the occurrence and prevention of the biological attack of cellulosic textile fibres.

According to Peat, the entire vegetation of the world has been estimated to contain carbon equivalent to 10^{12} kg. of carbon dioxide, and as the greater part of this carbon is to be found in two polyglucoses—starch and cellulose, the biological changes which take place in these two substances are of very great importance. This monograph, by giving a comprehensive account of the subject, serves an exceedingly useful purpose and it is to be hoped that many more in this series will in future be published on other interesting aspects of biochemistry.

P. S. SARMA.

Report on the Model Experiments for Bokaro Barrage D. V. C. By N. K. Bose and H. N. Mukherjee. (Damodar Valley Corporation, Calcutta.)

The report on the model experiments conducted at the River Research Institute, Bengal, for determining the flood levels, the position and profile of the Bokaro Barrage emphasises the need for hydraulic experiments before finalising designs. As a result of the experiments, it was found that by retiring the left guide bank, the accumulation of sand at the upstream left flank of the barrage could be minimised and the section of the barrage could be changed, making it more economical and efficient. In addition, it was also possible to verify the accuracy of many of the levels the river was supposed to have touched at various places during the record floods of 1935. Regarding experiments on the accumulation of sand at the left bank of the barrage, a few sets of experiments on the disposition of silting that is likely to occur due to different ratios of discharges in the Bokaro and Konar Rivers could have given more information on this problem. It is not clear why other remedies like silt vanes were not tried to prevent accumulation of sand. No mention has been made of the allowance to be made for the effect of distortion of horizontal and vertical scales on the lines of flow observed in the model.

Regarding experiments on the design of the profile of the barrage, the nature of flow that occurs beyond the toe of the bucket for low discharges could have been studied. It is well known that the nature of the flow can be shooting, create a surge, or get drowned depending on the tail water-level in the river. This in turn may create either a positive or a negative vertex flow at the toe and may cause retrogression of levels. It is important to run the model for all conditions of flow through the barrage and the corresponding tail-water conditions so that the most critical condition of flow may be determined. The cill proposed to form the bucket can be cut at intervals to allow the pebbles and shingles to pass through them and also drain out the flow that may accumulate in the buckets when all the gates are closed.

The report is exhaustive and is well prepared with numerous figures and photographs. The research workers are to be congratulated on the thoroughness with which they have carried out their studies.

N. S. GOVINDA RAO.

Books Received

- The Mind and the Eye.* By Agnes Arber. (Cambridge University Press), 1954. Pp. xi + 145. Price 16 sh. net.
- Analysis of Deformation*, Vol. 1. By Keith Swainger. (Chapman & Hall), 1954. Pp. xix + 285. Price 63 sh.
- Progress in the Chemistry of Fats and Other Lipids*, Vol. 2. By R. T. Holman, W. O. Handberg and T. Malkin. (Pergamon Press, Ltd.), 1954. Pp. 348. Price 63 sh. net.
- Tables of Coefficients for the Numerical Calculation of Laplace Transforms* (NBS Applied Maths, Series 30). (Govt. Printing Office, Washington 25 D.C.). Pp. 36. Price 25 cents.
- The Biology of the Cryptic Fauna of Forests.* By R. F. Lawrence. (A. A. Balkema, 1, Burg Street, P.O. Box 3117, Cape Town). Pp. 408. Price 50 sh.
- Nature and the Greeks.* By E. Schrodinger. (Cambridge University Press), 1954. Pp. 97. Price 10 sh. 6 d. net.
- Fifth Conference on Cotton Growing Problems in India.* (The Indian Central Cotton Committee, Ballard Estate, Fort, Bombay), 1953. Pp. xii + 116. Price Rs. 4.
- A Colored Atlas of Some Vertebrates from Ceylon*, Vol. 2. By P. E. P. Deraniyagala. (Ceylon National Museums Pub.). (The Ceylon Government Press). Pp. xvii + 93. Price not given.
- Advances in Carbohydrate Chemistry.* By C. S. Hudson and M. L. Walford. (Academic Press, Inc., Pub.), 1954. Pp. xvii + 408. Price \$ 10.00.
- The Printing of Mathematics.* By T. W. Chaundy, P. R. Barrett and Charles Batey. (Oxford University Press), 1954. Pp. ix + 105. Price 15 sh. net.
- Tables 10* (Antilogarithms to the Base 10). (N.B.S. Applied Maths. Series 27). (N.B.S. Office of Scientific Publications), 1953. Pp. viii + 543. Price \$ 3.50.
- Mammalian Hybrids.* By Annie P. Gray. (Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England), 1953. Pp. x + 144. Price 21 sh. net.
- The Biochemistry of Genetics.* By J. B. S. Haldane. (George Allen & Unwin, Ltd.), 1954. Pp. 144. Price 15 sh.
- Rocket Propulsion*, Second Edition. By Eric Burgess. (Chapman & Hall), 1954. Pp. 235. Price 21 sh.

SYMPOSIUM ON CHROMOSOME BREAKAGE*

THE suspicion that chromosome breakage and rearrangement may be one of the causative agents of malignancy has highlighted a study of these phenomena which had already assumed importance in view of their presumed role, along with gene mutations, in organic evolution. The foundation for investigations on chromosomal breakage had been laid nearly three decades back, when Muller discovered that the rate of their spontaneous occurrence could, like gene mutations, be accelerated by exposure to radiations. In spite of this, active work in this field is of very recent origin.

The volume under review consists of twenty-four papers which have been arranged in four parts, viz., (i) Radiation Breakage, (ii) Chemical Breakage, (iii) Secondary and Spontaneous Breakage, and (iv) General. Even though the phenomena dealt with are of sufficient importance to warrant a careful perusal by biologists belonging to the different disciplines, the use of specialized and exclusive terminology and symbols has tended to make the contributions intelligible only to those who have actively followed work in this field.

Many of the earlier conclusions have had to be modified in view of the evidence now available that chromosome breakages may be of different types. "Now we see that with each kind of treatment, the period of breakage may be limited in its own way. And with each kind of cell or nucleus, the period of union may be similarly limited or concentrated" (p. vii). There are many differences between the action of radiations and chemical mutagens. Unlike ionising radiations, chemical mutagens are capable of inducing breakage of heterochromatin in resting nuclei. In *Vicia*, while the breakage induced by chemicals is of chromosomes, the union is between chromatids.

The doubt is engendered whether breakages induced by chemicals are comparable to those arising after exposure to ionising radiations. As Revell remarks: "There is thus no *a priori* reason to expect that effects produced by mutagenic chemical compounds should show the same random distribution as those produced by ionising radiations, since there is no reason to

suppose that a chemical substance can act on the chromosomes in the sort of randomly corrosive fashion which has sometimes been assumed" (pp. 107-08).

The tetraploid cells and diplochromosomes seen in X-rayed tissue of *Triticum* (pp. 86-89) are attributed to the suppression of mitosis. During tissue differentiation the cells are known to become endopolyploid. Such transformations take place in the absence of a spindle. Whether ionising radiations could be used as a tool in investigations on the problem of endopolyploidy in relation to tissue differentiation would be worth attention. Reference is made by La Cour (pp. 173-74) to the very high percentage of breakage in the activated cells of the pericycle as a result of damage to the meristem. Unfortunately evidence is not available that differentiated cells when activated are all capable of normal dedifferentiation.

The cytological changes that accompany tissue differentiation still remain unexplored. Under the circumstances, it would be sheer optimism to expect that by pulling apart the chromosomes and thus the genes we would be able to get an idea not only of "how they work" but also of "what is needed to make them work" (Darlington, p. v). A careful perusal of published literature relating to *Drosophila* would show that when a cell becomes endopolyploid there may be differential reproduction of (a) chromosomes constituting the mitotic complement, (b) eu- and hetero-chromatin of the same chromosome, and (c) may be of even the different regions of the euchromatin. If these changes really do occur, different genic balances would be produced in different tissues. Thus the final picture may have no relation to what is seen in meristematic or germ cells. As Darlington states, the Symposium has produced answers to questions "that did not concern us more easily than those that did" (p. viii).

The volume would be a welcome addition to any cytological library.

M. K. SUBRAMANIAM.

* *Supplement to Heredity*, Vol. 6, 1953. Oliver and Boyd, London & Edinburgh. Price 45 sh.

SCIENCE NOTES AND NEWS

'Ekaholmium'

The Atomic Energy Commission, U.S.A., has announced that a new element, number 99, has been produced. This is the seventh artificial element to be added to the list of the traditional 92 chemical elements.

The new substance has an atomic weight of 247, is radio-active and short-lived and in a few minutes changes into element 97. It is not likely to be useful for atom bombs or power; it is not fissile. As with all the new elements heavier than uranium, number 99 was made by adding nuclear particles to uranium. The new element to which no name has yet been given is chemically related to holmium.

Germanium from Lignite

Since the discovery in 1952 that lignite contained germanium, trials have been made to extract germanium economically. It is now reported from Japan that these trials have been successful and that a factory is being established near Tokyo for its extraction. It is hoped to produce 5 lb. of germanium oxide from 400 tons of lignite a month. Plants for the manufacture of metallic germanium are to be added later. In addition to germanium, the factory will produce tar, activated coal and gallium.

Fat from Fungi

S. Murray, M. Woodbine and T. K. Walker (*J. Exp. Bot.*, 4, 11, 251; 1953) have reported on the growth, development and fat formation of some forty-three strains of ten species of fungi when grown on different sucrose-containing media. The highest three yields of fat were given by *Penicillium javanicum* van Beyma, *P. soppi* Zaleski and *Aspergillus nidulans* Eidam, in that order. The fat content on fat weight was maximal at 34.8 per cent. with *P. soppi* at 28.4 per cent. with *Fusarium lini* (I), and at 25.8 per cent. with *A. nidulans*; on sugar utilized it was maximal at 11.4 per cent. with *P. soppi*, at 7.9 per cent. with *A. nidulans*, and at 5.6 per cent. with *F. lini* (I). Other moulds are also being considered in this connection.

old have been discovered on the northern shore of Lake Superior. The discovery was made in a deposit of flint rock in an iron formation near Schreiber, Ontario. The fossils were found to be blue green algae and simple forms of fungi. Professor Patrick Hurley of the Massachusetts Institute of Technology determined the age of the fossils.

Translations of Russian Papers on Physics

Arrangements have been made in the USA to translate some 1,000 pages of current Soviet papers on physics during 1954. At the same time new terms will be recorded for incorporation in a Russian-English scientific glossary. The translations will be published by the U.S. Atomic Energy Commission, and copies will be purchasable from the Office of Technical Services, Department of Commerce, Washington, D.C.

UNESCO Translation Guide

Bibliographical notes on 16,130 works translated in 49 countries are contained in the fifth volume of "Index Translationum", an International Bibliography of Translations, which has just been published by UNESCO. A book of 512 large-format pages in French and English, it covers translations published during 1952 and also translations issued since 1948 which had not been listed in the previous volumes of the Index. Some of the countries in the new volume are represented for the first time; others, which had previously appeared with only fragmentary bibliographies, are now presented in more or less complete detail.

The compilation of "Index Translationum" represents the combined efforts of bibliographers all over the world. The work, which every year becomes larger and more complete, is a valuable working instrument not only for library workers, publishers and translators, but generally for all persons interested in the exchange of ideas and knowledge between peoples and between the great cultural zones. Price \$ 7.50; 42 sh.; 2.00 frs. on sale at National Distributors of UNESCO Publications.

Fossils 2,000 m. Year Old

Plant fossils believed to be the oldest yet and estimated more than 2,000 million years

UNESCO Aids to Science Teaching

UNESCO is publishing a series of 80 workshop designs, or "blueprints" for the produc-

tion of school science equipment by small industries or by vocational schools. There is one portfolio of 80 drawings for elementary schools and another of 76 drawings for secondary schools and university laboratories. They are prepared in the international engineering code and the drawings themselves contain no words so that they are useful in any language. Accompanying them are sheets with full specifications for the purchase of the raw materials, instructions for manufacture on a small scale and on a large scale and instructions for the use of the equipment by the teachers. With the aid of the "know-how" provided by UNESCO's drawings, many underdeveloped countries will be able to establish the manufacture of scientific equipment and instruments which is essential for science teaching in the schools.

UNESCO has also undertaken to organize science teachers' Associations in various countries and is engaged on the continuing study of the curricula used in science teaching throughout the world.

World Medical Periodical

The UNESCO has just published a bibliographical guide, of more than 250 pages to World Medical Periodicals including journals devoted to dental and veterinary surgery as well as pharmaceutical organs. This highly useful reference work has been priced at 12 sh. 6 d.

Third International Congress of Nutrition

The Congress is to be held during September 13-17 at Amsterdam and is expected to serve as a forum for exchange of views on various aspects of nutrition problems. The Organizing Committee sincerely hopes that numerous students of this vast and interesting field, especially also the younger persons, will seize this opportunity of coming into contact with research workers of experience and renown. The main emphasis will be on symposia on the topics: "Nutrition and Disease" and "Food Additives", as these subjects are at present being studied with particular interest. Applications for membership should reach the Secretariate, J. D. Meyerplein 3, Amsterdam, before 1st April 1954.

Symposium on Vegetation Types of India

The Indian Botanical Society will be holding a Symposium on 'Vegetation Types of India' at the annual meeting to be held at Baroda in the first week of January 1955. Workers in the field are invited to participate in the deliberations and inform Dr. R. Misra, the Convener, Department of Botany, University of Saugar, Sagar, immediately of the title of the paper they would like to read. The manuscript with a brief abstract should reach him before September 1954. It is proposed to publish the Symposium at an early date.

Progress of Botany in India

With reference to the Progress Report sponsored by the Indian Botanical Society on the above and announced in our Journal (1953, 22, 295), the following changes have been forwarded to us for notification: (4) Pteridophyta—Mr. N. P. Chowdhury, Lecturer in Botany, University of Delhi, Delhi-8, in place of Dr. T. S. Mahabale. (10) (b) Ecology—Dr. G. S. Puri, Forest Ecologist, Forest Research Institute, New Forest, Dehra Dun, in addition to Dr. R. Misra. (12) Vegetative Anatomy of Angiosperms—Dr. G. C. Mitra, Department of Botany, University of Delhi, Delhi-8.

The last date for submission of reports has been extended up to July 1, 1954.

Award of Research Degree

The University of Saugar has awarded the Ph.D. Degree in Genetics to Shri Y. Sundar Rao for his thesis entitled "Karyo Systematic Studies in Helobiales with Some Observation on Genistae".

The University of Saugar has awarded the Ph.D. Degree in Botany to Shri S. C. Pandeya for his thesis entitled "Ecological Studies of Grasslands of Sagar".

The Gujarat University has awarded the Ph.D. Degree in Chemistry to Shri B. P. Bangadiwala for his thesis entitled "Studies in the Synthesis of Hydroxy Quinolines and Halogenation of Ethyl B-arylaminoacetonates".

The University of Poona has awarded the Ph.D. Degree in Chemistry to Shri K. R. Chandorkar for his thesis entitled "Synthesis of 6-Benzoyl-4'-methoxyflavone and 5-benzoyl-4'-benzylidenecoumaranone by Kostanecki and Feurstein reaction, etc.".



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